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# GROUNDWATER-RELATED PROGRAMS OF THE USGS AND THE EPA

# HEARINGS

BEFORE THE

SUBCOMMITTEE ON WATER AND POWER

OF THE

COMMITTEE ON
ENERGY AND NATURAL RESOURCES
UNITED STATES SENATE

ONE HUNDREDTH CONGRESS

FIRST SESSION

ON THE

CURRENT WATER-RELATED PROGRAMS OF THE U.S. GEOLOGICAL SURVEY AND THE ENVIRONMENTAL PROTECTION AGENCY WITH EMPHASIS ON GROUNDWATER

JUNE 5 AND 18, 1987

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# GROUNDWATER-RELATED PROGRAMS OF THE USGS AND THE EPA

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FRIDAY, JUNE 5, 1987

U.S. SENATE,
SUBCOMMITTEE ON WATER AND POWER,
COMMITTEE ON ENERGY AND NATURAL RESOURCES,
*Washington, DC.*

The subcommittee met, pursuant to notice, at 9:30 a.m., in room SD-366, Dirksen Senate Office Building, Hon. Bill Bradley, presiding.

## OPENING STATEMENT OF HON. BILL BRADLEY, A U.S. SENATOR FROM THE STATE OF NEW JERSEY

Senator BRADLEY. The subcommittee will come to order. Today the subcommittee will receive testimony concerning current water programs of the United States Geological Survey, and the Environmental Protection Agency, with an emphasis on groundwater resources.

Let me say that nothing is more fundamental to the survival of mankind than the availability of water. Wars have been fought over it, and development of communities and countries is shaped by its availability. It is easy to destroy water supplies, and difficult and expensive to reclaim them.

The purpose of the hearing this morning is to receive testimony from these two agencies regarding their respective water resource programs. And as I said earlier, with a particular emphasis on groundwater.

An additional day of hearings before the subcommittee has been scheduled for June 18. That session will focus on non-Federal witnesses, including state, industrial and environmental representatives and their views on groundwater issues facing our nation.

In the past the Committee on Energy and Natural Resources has focused on water supply issues in the western states, including the development of surface water supplies and aquifer recharge technology.

Today marks this Committee's first effort to help provide a broader information base upon which Congress may draw in addressing national groundwater policy, and the problems attendant thereto.

We will examine the ongoing programs of the United States Geological Survey and the Environmental Protection Agency, and ultimately the appropriate Federal role in protecting groundwater resources.

I know that many western Members of the Committee have real concern for the role that the states, and in particular state water law, may have in groundwater protection programs.

I can assure them that I am sensitive to this issue. In turn I would like to express my own views on the extraordinary complexity of the groundwater resource, and the need for imaginative approaches, and some real flexibility. Thinking in some new and different categories.

Ground water cannot be considered a resource in isolation. It is effected by all of man's activities. As John Muir reminds us about our natural resources, and frankly about the environment, he says, "when we try to pick out anything by itself, we find it hitched to everything else in the universe."

This principle is clearly demonstrated in the relationship between the activities of man and the quality of our water resources. A good example is the apparent correlation between the phase-out of lead in gasoline as a result of the Clean Air Act, and the dramatic downward trend in the lead content of surface waters in the United States.

Whatever we do, whether on ground or underground, we must recognize the inevitable impact that our activities will have on water resources and on groundwater in particular.

The statistics are frankly startling. Approximately 120 million people depend on groundwater for domestic uses. And I am one of them. Eighty percent of our nation's irrigated crop lands used groundwater.

Groundwater fulfills 90 percent of the needs of rural America for water supplies. Given the magnitude of our dependency, we cannot afford to jeopardize this resource.

I am optimistic that despite the many threats to, and examples of, groundwater contamination, we are not yet in a crisis situation. On the contrary, we have an opportunity to prevent problems rather than simply to respond to catastrophes.

As I believe the witnesses will attest in today's hearing, the costs of cleaning up aquifer damage are astronomical, while the costs of prevention are not nearly so great.

Today's hearing begins the process of collecting information so that the Congress and the public can act in a responsible and timely manner. And I am hopeful that today's hearing and the further discussion it will generate will be helpful to my colleagues on the Energy and Natural Resources Committee, as well as the whole Senate and the Congress.

So let us begin with our first panel that consists of Mr. Doyle G. Frederick, Associate Director of the United States Geological Survey, who is accompanied by Mr. Phil Cohen, Chief Hydrologist of the USGS.

Welcome to the subcommittee, gentlemen. Please proceed with your testimony, and then we will go to questions.

## STATEMENT OF DOYLE G. FREDERICK, ASSOCIATE DIRECTOR, U.S. GEOLOGICAL SURVEY, DEPARTMENT OF THE INTERIOR; ACCOMPANIED BY PHILIP COHEN, CHIEF HYDROLOGIST

Mr. **Frederick**. Thank you very much, Mr. Chairman. I am pleased to be here to appear before the subcommittee to discuss the U.S. Geological Survey programs and activities.

As you mentioned, my name is Doyle Frederick. I am the Associate Director of the U.S. Geological Survey. With me this morning is Mr. Philip Cohen, the Chief Hydrologist. Phil is the line manager responsible for Geological Survey water-related activities.

We are pleased to be here to talk about Geological Survey activities, and in response to your request we will use this hearing to describe our programs and our activities with emphasis on ground water.

I will say a few words about the Geological Survey and then turn the hearing over to Mr. Cohen, who will discuss in some detail the programs and activities.

First I might just mention a little bit about the Geological Survey itself. It is the principal earth-science organization for the Department of the Interior and the Federal Government.

Our activities span a wide range of earth-science research, investigation and services in the fields of geology, hydrology, and mapping. Basically, our role is to provide information on earth-science resources for the decisionmakers of the country. And we hope to elaborate a bit more on that particular role with respect to water resources.

More than a third of our activities and total resources are directed to water-related programs. The Geological Survey has a hydrologic staff of more than 4,000 people, including about 1,700 professional hydrologists, geologists, engineers, chemists, and biologists, located in all 50 States, Puerto Rico and the Trust Territories.

Funding for our programs is on the order of about $267 million from all sources. The sources include appropriated fund provided to us by State and local government agencies, through our Federal-State Cooperative Program, and funds provided by other Federal agencies.

About half of that total is related to ground water in one way or another, both ground-water quality and quantity. And more and more of our activities in the ground-water area are being devoted to water quality related issues.

The principal goal of the Geological Survey's water program, including ground water, is to develop the technical and scientific information to support activities undertaken by others, at all levels of government, in making the tough decisions that have to be made.

And that includes substantial input and cooperation with our colleagues from the Environmental Protection Agency, doing the very difficult job that they have to do.

We are addressing this goal, the goal of providing basic information on the water resources, in what we believe to be a balanced program of data collection, applied and basic research, which is coordinated very, very closely with State and local government agencies as well as with Federal agencies who have water resources issues that they must deal with.

I might mention here that a major component of our work is with the State and local government agencies. These activities are executed through our Federal-State Cooperative Program. The Federal-State Cooperative Program is a rather unique program.

It is one in which the State and local government agencies contribute 50 percent of the funds, and the USGS contributes 50 percent of the funds, to execute programs to which we mutually agree—programs with national interest as well as regional and local interest.

We think this is an excellent relationship. It provides an excellent infrastructure for carrying out programs that work for those agencies as well as at the Federal level.

The Federal-State Cooperative Program involves about 950 cooperators throughout the country, and Mr. Cohen will talk a bit more about the program in just a few minutes. From our view, it is a unique cooperative program as well as an excellent conduit for technical assistance.

Now turning specifically to ground water, let me just say a few things. In spite of many years of data collection, about 100 years on the part of the U.S. Geological Survey and fewer years of very intensive efforts on the part of EPA, other Federal agencies and State and local governments, we have learned a lot. But there is a great deal more to be learned, as you mentioned, Mr. Chairman, earlier in your comments.

Some of the areas that we would just like to mention very briefly, where we think maybe more needs to be learned, are areas we are concerned about when we develop U.S. Geological Survey programs. These include: the development of reliable and cost-effective laboratory and field methods for collecting and analyzing chemicals in ground water, especially organic compounds, trace metals, and other substances; laboratory and field techniques to understand and describe the movement of dissolved or otherwise contained substances in ground water; and field studies using both existing data as well as newly acquired data to determine the quality of ground water, both as a function of time and space.

Mr. Cohen will talk in detail about some of our programs in just a few minutes. I will leave that part out of my testimony. But we do have several activities that run the gamut from fundamental basic research to regional and national appraisals and analyses to studies of specific contamination plumes that we think contribute to those issues.

Specifically, when we design programs, and when we look at priorities and funding, we consider those issues that I mentioned earlier, and we consider specific objectives that will help us deal with the issues relating to the physical chemistry and biology of, as I mentioned, individual plumes.

The character and impact of non-point source pollution on ground water quality conditions—Is it getting better? Is it getting worse? Especially with regard to organic compounds and trace metals.

We are looking to be conscious of the problems relating to the nature and extent of ground water contamination, again both on a regional and national basis as well as on the local basis.

I mention this from the point of view that we are trying to be concerned about the broad range of issues that need to be dealt with. We are sometimes criticized by some, who have problems that they have to deal with today, that our information does not come soon enough or is not absolutely pertinent to the programs at hand at the moment.

We do not believe that is true, and we are working very hard to make sure that we pay attention to information needs. I expect that you will hear in the EPA testimony of a lot of programs and activities that relate to those kinds of problems, and we are working very hard to cooperate with EPA to provide a sound foundation for now and for the future, as well as to help deal with some of the problems that they have at the moment.

So, with that brief introduction just one final comment and then I will turn the meeting over to Mr. Cohen, if that is okay with you. We do not manage ground water nor do we set policy nor do we regulate.

But we do think we have a role. We think that role is best described in terms of defining the resource, and defining it accurately and in a timely manner, also defining it in such a way that folks who have to make the tough choices in the trenches can use our information.

So with that brief introduction, Senator Bradley, I would like to turn the meeting over to Mr. Cohen.

[The prepared statement of Mr. Frederick follows:]

Statement of Doyle G. Frederick
Associate Director, U.S. Geological Survey
before the Subcommittee on Water and Power
of the Committee on Energy and Natural Resources, United States Senate
June 5, 1987

Mr. Chairman, members of the Committee, my name is Doyle Frederick. I am Associate Director of the U.S. Geological Survey (USGS). It is a pleasure to be here today to comment on some of the scientific activities of the Geological Survey, and to describe elements of our water-resources programs. I am accompanied by Mr. Philip Cohen, who is our Chief Hydrologist, and who is the line manager of the Survey's water-related programs. I will first describe the general nature of our programs, and Mr. Cohen will follow with a discussion of selected elements of our water-related programs. Our presentations will provide a brief overview of our water programs but, at your request, will emphasize ground water.

The USGS was established by an act of Congress on March 3, 1879, to answer the need for a permanent government agency at the Federal level to conduct, on a continuing, systematic, and scientific basis, investigations of the "geological structure, mineral resources, and products of the national domain." Although a number of laws and executive orders have expanded and modified the scope of the Survey's responsibilities during its 108-year history, it has remained principally a scientific and technical investigation agency.

The USGS is the principal source of scientific and technical expertise in the earth sciences within the Department of the Interior (DOI) and the Federal Government. Our activities span a wide range of earth-science research investigations and services in the fields of geology, hydrology, and cartography, and represent the continuing pursuit of our long-standing scientific mission. For example, the USGS is mandated to assess onshore and offshore energy and mineral resources; to provide information for society to mitigate the impact of floods, earthquakes, landslides, volcanoes, and droughts; to assess the Nation's ground-water and surface-water resources, including the impacts of human activities on those resources; and to provide mapped information on the Nation's landscape and land use.

More than one-third of the Geological Survey's total resources are directed toward our water-related programs. The USGS hydrologic staff of more than 4,000 people--including 1,700 hydrologists, geologists, engineers, chemists, and biologists--is the largest such group in the United States, and is currently conducting field or laboratory investigations in the 50 States, Puerto Rico, and the Trust Territories. Total funding of USGS water-related programs in fiscal year 1987 is about $267 million, and is derived from a variety of sources, including directly appropriated funds, funds provided by other Federal agencies, and funds provided by the Federal-State Cooperative Program, wherein costs of hydrologic investigations are shared equally by State and local governmental agencies and the USGS. Funding for the Federal-State Cooperative Program in fiscal year 1987 is about $100 million, with the USGS providing about 50 percent of the funding (and conducting virtually all of the investigations in-house) and some 950 State and local agencies providing the additional $50-plus million. This is by far the largest technical assistance program of its kind in the Nation.

Organizationally, our hydrologic expertise is widely dispersed, with four regional administrative and technical centers, three Research Centers, 43 District offices that largely coincide with State boundaries, and more than 150 Subdistrict and other field offices where the bulk of our technical activity is accomplished.

Before considering our ground-water programs, at this point I would like to list for the record our other major water-related programs which, because of time limitations, we will not be able to discuss today. They include:

(1) Collecting and interpreting basic data on streamflow quantity at about 11,000 "gaging" stations,

(2) Collecting and interpreting surface-water quality at about 4,200 stations,

(3) Managing the "National Trends Network" for determining precipitation chemistry and operating 50 of the 150 stations in the network,

(4) Coordinating water-data activities at the Federal level,

(5) Providing certain water information "clearinghouse functions" through our National Water Data Exchange and National Water Resources Scientific Center Programs,

(6) Preparing the annual National Water Summary,

(7) Compiling national water-use information and supporting collection of such information by the States, and

(8) Collecting basic water data and doing applied and basic research related to coal hydrology.

As with all our activities, the principal goal of the USGS' ground-water programs is to develop technical and scientific information to support activities by others at all levels of government and in the private sector relating to planning and decisionmaking regarding such issues as allocation, design, construction, legislation, regulation, etc. The scope of our work ranges from long-term ongoing measurements of ground-water levels at about 27,000 sites and ground-water quality at about 4,000 sites throughout the Nation, through a wide range of applied research field studies, to basic research in the laboratory and in the field. In fiscal year 1987, this amounts to about 500 separate projects funded at about $110-120 million. Major emphasis in the USGS' ground-water work has shifted dramatically in the past several decades from ground-water availability (in an quantitative sense) to ground-water quality (mainly chemistry).

Despite the large amount of ground-water work completed by the USGS and by others during the past 100 years or so (at an increasingly rapid rate in recent years) much remains unknown about the Nation's ground water, especially its ground-water quality. And the USGS' current ground-water programs are placing ever-increasing emphasis on many of these unknowns to assist public policymaking as well as to serve the previously mentioned principal goal of the programs. The areas of greatest information deficiency and, accordingly, increasing areas of USGS activity include three broad categories:

(1) Adapting and developing new laboratory and field methods for analyzing and collecting chemicals in ground water, especially, organic compounds, trace metals, and other dissolved trace substances (for example, selenium),

(2) Theoretical and applied laboratory and field studies of the movement of dissolved or otherwise contained substances in ground water, including chemical and physical changes of the substances themselves, and changes in aquifer properties as a result of interaction with the chemicals, and,

(3) the distribution of chemicals in ground water, both in space and time.

I would now like to describe briefly the major components of the USGS' investigative programs that are directed in whole or in part toward ground water. These include (1) the Federal-State Cooperative Program, (2) the Regional Aquifer-System Analysis Program, (3) the Nuclear Waste Hydrology Program, (4) the Toxic Substances Hydrology Program, (5) the National Water-Quality Assessment Pilot Program, and (6) the National Research Program.

The Federal-State Cooperative Program has been active for nearly a century and many ground-water studies have been conducted in each of the 50 States, Puerto Rico, and the Trust Territories. The vast literature that has been developed by this program comprises the bulk of information that describes the extent and character of the Nation's aquifers, and the occurrence, nature, and chemical quality of the ground water. Information obtained from over 900,000 wells is stored in our computer files. Most of this information was developed through the Federal-State Cooperative Program.

The Regional Aquifer-System Analysis Program (the RASA Program) represents a systematic effort to study a number of regional ground-water systems which together cover much of the country and which represent a significant portion of the Nation's water supply. There have been 28 systems identified for study under the program, of which 20 are currently active or have been completed. In general, the boundaries of these systems are identified using hydrologic considerations and, accordingly, transcend the political subdivisions to which hydrologic investigations commonly have been limited in the past. The overall objectives of the RASA Program are to provide an understanding of existing ground-water flow systems and water-quality distributions on a regional scale; to provide predictive capabilities, through the use of computer simulation through which the consequences of future development can be evaluated; and to provide a regional hydrogeologic framework for more detailed local investigations.

Activities of the Nuclear Waste Hydrology Program address two program components concerned with gaining a better understanding of the ground-water environment surrounding actual and proposed nuclear-waste repositories.

- The High-Level Radioactive Waste Program is concerned with the development of geohydrologic criteria to guide the selection of suitable deep disposal environments for highly radioactive nuclear material. The activity involves both a hydrogeologic screening process for identifying environments that possess multiple barriers to the migration of nuclides, and that can effectively isolate the waste for tens of thousands of years; and the development of understanding of the critical hydrogeologic properties and processes involved in the transport of nuclides from a repository to the biosphere. In addition, with funding support from the Department of Energy, the Geological Survey has the lead role in evaluating the geology and hydrology of the candidate repository at Yucca Mountain, Nevada.

- The Low-Level Radioactive Waste Program is concerned with hydrologic studies at a variety of low-level waste repositories to assess processes and geohydrologic parameters controlling nuclide migration in ground water. The objective of the program is to determine the geologic and hydrologic conditions suitable for the shallow burial and containment of low-level radioactive wastes. Information developed by the Geological Survey assists the Environmental Protection Agency, the Nuclear Regulatory Commission, the Department of Energy, and State agencies in the formulation of standards, technical criteria, and regulations for low-level waste management.

The Toxic Substances Hydrology Program addresses nonradioactive contaminants in ground water and surface water such as industrial byproducts, effluent from landfills, or accidental spills. The program is designed to improve our understanding of the geologic factors and hydraulic, chemical, and microbiologic processes that control the movement and fate of contaminants in water. The program includes several types of investigations to evaluate and enhance our current abilities to predict contaminant movement and to develop analytical methodologies and sampling procedures.

The three major elements of this program are (1) process-oriented research and methods development related to contaminants in both surface-water and ground-water systems, (2) intensive interdisciplinary field research at sites where ground water and surface water have been contaminated by specific types of chemicals, and (3) improvement of existing methods for the collection, analysis, and interpretation of hydrochemical information at the regional scale so as to document the extent and magnitude of contamination and the relation of that contamination to human activities.

The Geological Survey, in consultation with other Federal agencies and States, has begun pilot studies associated with the testing, development, and evaluation of concepts for a National Water-Quality Assessment (NAWQA) Program. A national water-quality assessment effort would build upon an existing base of ongoing water-quality activities of the USGS, as well as other Federal, State, and local agencies. The information developed by such a program could serve to identify problem areas (and document non-problem areas as well) and assist in measuring progress toward achieving national water-quality objectives.

The Pilot NAWQA Program was begun in fiscal year 1986 and currently involves the conduct of seven pilot studies of surface- and ground-water quality wherein methodologies for the conduct of a national assessment are being developed and tested. Information developed by a NAWQA Program could provide a basis for better informed decisions on policies designed to protect the water resources of the Nation, and could contribute to more effective decisions on remedies for many existing water-quality problems. The pilot NAWQA effort is designed to determine the potential benefits of a full-scale NAWQA, specifically to provide information which will allow us the opportunity to evaluate the utility of a full-scale NAWQA. In addition, an extramural research effort is nearly completed, aimed at answering some of the economic and policy questions related to the potential uses and utility of NAWQA-type information. Federal, State, and local agencies are actively involved in the pilot programs and are serving on study unit liaison committees. A National Coordinating Work Group on NAWQA has been formed and includes high-level representation of Federal, State, local, and private sector interests. All of these groups have expressed their interest and willingness to work with the DOI and the USGS to help further define ways that the Pilot NAWQA Program can achieve the greatest possible utility to the broad spectrum of information users that these groups represent. In addition, the National Academy of Sciences will participate in evaluating the pilot program and will provide DOI and USGS the results of that analysis.

The National Research Program conducts basic and applied hydrologic research to increase the understanding of the fundamental hydrologic processes controlling the movement of water and chemical constituents in the Nation's ground- and surface-water systems. Of the approximately 180 individuals engaged in the National Research Program, about half are pursuing activities that focus directly on the characterization of aquifer systems, the identification of chemical or geochemical processes, and the development of simulation techniques that will afford a greater confidence in our predictive capabilities. Of the 110 research projects now active, about 50 contribute to the better understanding of the physical, chemical, and biologic processes that is essential to effective management of the ground-water resource. In many instances, elements of the National Research Program are deeply involved with problem-oriented studies in the Federal-State Cooperative, RASA, or Hazardous-Waste Programs. Such joint efforts benefit both the researcher, who has first-hand opportunity for addressing new or emerging technical problems, and the field investigator, who has the opportunity of applying state-of-the-art technical assistance. This unusually close association has been highly successful, and will continue to accelerate the pace at which solutions to the ever-increasing problems of ground-water management and protection can be developed.

This brief overview of the Geological Survey's ground-water programs is intended to describe a large national technical organization engaged in virtually all aspects of scientific hydrology, and operating at widely different geographic scales. While the USGS does not manage ground water, and does not set regulations or formulate policy, it does provide the water manager and the policymaker technically sound and unbiased data and interpretive products.

We are working to ensure that the interlocking and mutually supportive programs of the USGS continue to provide information, and especially to fill vital information gaps, to further the effective management and protection of the Nation's ground-water supplies.

# GROUND-WATER SUPPLY AND CONTAMINATION--
# A U.S. GEOLOGICAL SURVEY PERSPECTIVE
May 1987

Ground water is among the Nation's most important natural resources, supplying drinking water to about half of the total population and to over 90 percent of the rural population. Development of ground water has steadily progressed over the last century, accompanied by a gradually shifting emphasis from exploration for new supplies to management of existing supplies. That shift has occurred partly because much is now known about the distribution, physical characteristics, and potential yield of aquifer systems (at least on semi-regional scales), and partly because, as the result of development, the resource has become strained, resulting in unanticipated water-level declines, higher pumping costs, and in some cases, irreversible depletion of ground water. Over the past several decades, a growing awareness has developed that an additional phenomenon has been superimposed on our aquifer systems - the contamination of ground water by toxic industrial, domestic, and agricultural wastes. The need to define the extent, nature, and degree of contamination, as well as the toxicological effects of the contaminants, now dominates the national concern.

The purpose of this informal paper is to describe briefly the nature and status of the Nation's ground-water systems, and to contrast our capabilities in defining flow characteristics of the systems with our capabilities in describing the extent and effects of contamination within those systems.

## GROUND-WATER SYSTEMS

Interconnected pores, fractures, or solution openings are found in almost all of the rocks and sediments which make up the solid framework of the earth. A percentage of the precipitation which falls on the earth's surface infiltrates this system of openings and percolates downward, ultimately reaching the water table. Below the water table, the porous framework of the earth is completely saturated; given sufficient time, water will collect in wells or test holes which penetrate below this depth. This condition of saturation can be found at some depth almost anywhere in the world. Where the saturated permeable material can yield economically significant quantities of water, the body of rock is called an aquifer.

Under natural conditions, the ground water in the saturated regime, below the water table, is generally in motion from areas of recharge (from precipitation) to points of discharge at the surface. Normally the recharge is widely dispersed; the discharge is usually to streams, although it may also occur as transpiration by plants, or as direct seepage to the sea in coastal areas. Under natural conditions, an equilibrium generally prevails in which the long-term recharge to the ground-water system is balanced by the long-term discharge from it. We tend to speak of ground water in terms of distinct aquifers and impervious units, or in terms of artesian conditions and water-table conditions. However, the natural ground-water regime is probably better visualized as a unified flow system, in which water moves through a heterogeneous framework of geologic materials, some of which are highly permeable and others but slightly so. The system is characterized by superimposed patterns of circulation, ranging from shallow, local flow into small upland streams, to deep regional circulation toward major drainage features.

Although saturated conditions can be found almost anywhere if drilling is carried to a sufficient depth, it is not true that ground-water supplies can be developed anywhere. Such development is possible only where the geologic materials are sufficiently permeable to allow water to move readily into a well, and where the water is of a quality suitable for use. When pumpage of ground water is initiated, ground-water levels decline as water is withdrawn from storage. Ultimately, withdrawal from storage may cease, and a new equilibrium may be established in which the rate of recharge balances the pumpage and the remaining natural discharge. On the other hand, if the pumping rate exceeds the reductions in natural discharge and the increases in recharge which can be effected in the system, withdrawal from storage will continue until falling water levels force a reduction in pumping rates. An equilibrium is then established in which the natural discharge and this reduced pumping rate are balanced by the recharge.

The time required for a system to reach equilibrium varies widely. For highly-permeable systems in areas of plentiful recharge, such as some of the limestone regions of Florida, a new equilibrium can be attained within a matter of days following an increase in pumpage. In the Southern High Plains, on the other hand, where pumpage far exceeds the reductions in natural discharge or the increases in recharge which can be effected, withdrawal from storage has continued for decades, and no equilibrium will be attained until rates of pumping are diminished by falling water levels.

In addition to the decline of water levels that inevitably accompany pumping, other effects of pumping are important in some parts of the country. The encroachment of saline water into freshwater aquifers is an ever present threat along the highly productive coastal aquifers of the United States, and deep saline water that underlies aquifers in the interior of the country can contaminate pumping wells by "upconing" or rising to the well intake. It is important to note that such saltwater contamination of aquifers is a purely hydraulic effect of pumping, and that with sufficient knowledge of the hydrologic setting, coupled with the use of existing analytic tools, it can be predicted, and controlled by appropriate balancing of well placement and discharge.

In other areas of the country, notably the Gulf Coast, San Joaquin Valley of California and southern Arizona, ground-water withdrawals from unconsolidated sediments have been accompanied by the gradual sinking, or subsidence, of the land surface. In the Houston area, the land surface has subsided more than 1 foot over a 5,000-square mile area, and in the San Joaquin Valley, the maximum (vertical) subsidence has been about 29 feet. In both areas, the subsidence is attributable to the high clay content of the deep aquifers and to large pressure declines caused by pumping. The pressure declines cause the clays to slowly yield water to the aquifer, and to compact in proporation to the volume of water lost. On a regional scale, the result of this process is a slow settling of the land surface in proportion to the total volume of water lost by the clays. In both the San Joaquin Valley and the Houston areas, the subsidence has been slowed or stopped by reducing pumpage. Unlike saltwater intrusion, which can be slowly reversed, such subsidence is an irreversible process, and the decline in land surface is permanent.

Although subsidence and saline intrusion are highly important consequences of ground-water pumping, at a National scale these phenomena currently affect only a small part of the total ground-water resource. As pumping rates increase in the future, however, greater attention may be required.

The preceding discussion does not imply that withdrawal of ground water from storage is necessarily undesirable. In fact, no development of ground water is possible without withdrawal from storage, since this is necessarily the first process which must occur in response to pumpage. Even sustained storage withdrawal, or as it is often termed, "ground-water mining," may often be beneficial and economically viable, analogous to the mining of other mineral resources. The critical factor is that the operation be recognized for what it is, and that the time-dependent nature of the operation be taken into account in any economic evaluation of its merits.

As the preceding discussion suggests, ground water and surface water are not two independent sources of water, but rather are two interrelated parts of the hydrologic cycle. Development of ground water inevitably affects streamflows, except in cases where the entire natural discharge was to evapotranspiration or to the sea. In many applications, of course, some of the pumped ground water ultimately is discharged to streams or returned by seepage to the ground-water system after a cycle of use. In these cases, the impact of pumpage on streamflow is reduced, but may be replaced by an impact on water quality.

Virtually all ground-water travel times under natural conditions always tend to be low. The shortest travel times are normally found in very shallow ground-water circulation toward local upland streams, where times of travel from recharge to discharge point may be measured in months or years. Velocities tend to become smaller with depth, and distances of flow become greater, so that times of travel measured in decades, centuries, and millenia are commonly calculated in deeper ground-water flow systems.

Management of ground-water supply and ground-water quality is today increasingly based on the technology of computer simulation of aquifer systems--that is, the process of creating mathematical models of an aquifer system, through which the equations describing the system can be solved on a digital computer. This allows the hydrologist or water manager to predict the hydraulic consequences, and for some simple cases, the chemical consequences of a proposed scheme of pumpage or waste disposal before that scheme is implemented in the field.

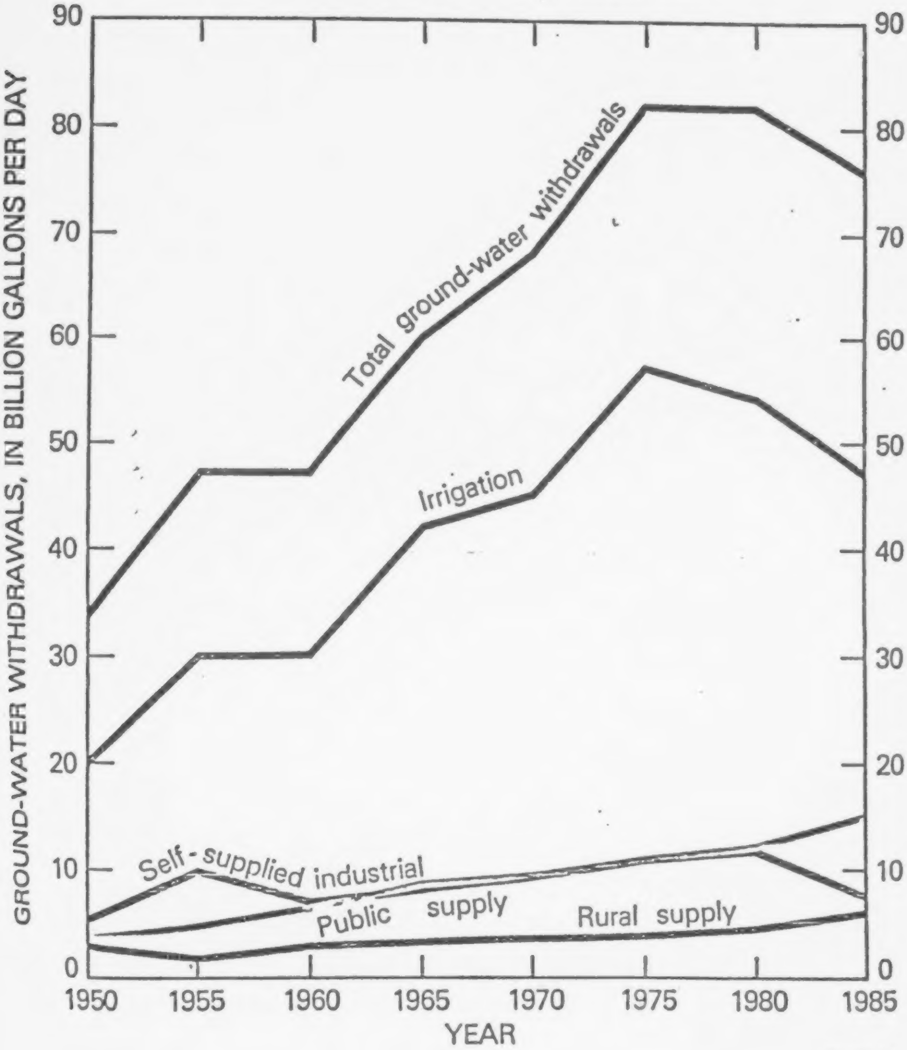
## GENERAL STATUS OF THE NATION'S GROUND-WATER RESOURCES

The volume of ground water presently in storage in the Nation's aquifer systems has been estimated to be on the order of 100 quadrillion gallons, or about 16 times the volume of the Great Lakes. However, at least half of this volume represents deep lying saline water, with little or no potential for development. The flow through the ground-water system in the United States has been estimated at one trillion gallons per day. This includes a large percentage of very shallow circulation, which presently discharges to surface streams without reaching major aquifers, but some of which could presumably be diverted into deeper patterns of flow in response to pumpage.

The pumpage of ground water in the United States in 1985 was estimated at approximately 76 billions gallons per day, which is on the order of 10 percent of the estimated natural flow through the Nation's ground-water systems. Viewed in a national sense, therefore, the resource is not overdeveloped; locally, however the situation can vary widely, and a number of problems exist.

Ground-water pumpage for public and rural supplies has increased steadily over the last three decades, but irrigation withdrawals have declined since 1975, as shown in figure 1. The total ground-water pumpage in 1985 represented

TRENDS IN GROUND-WATER WITHDRAWALS, 1950-85



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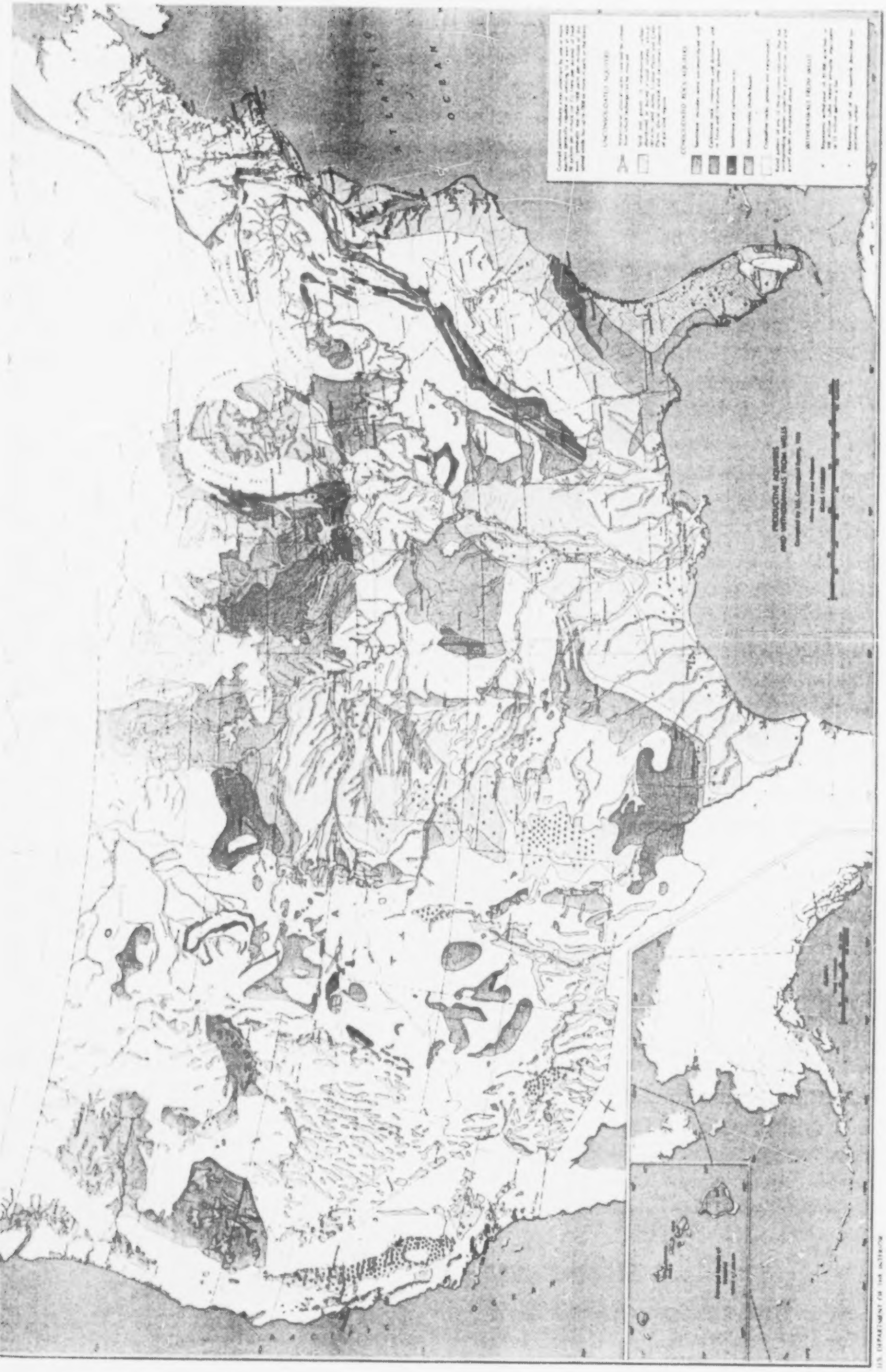
almost 20 percent of the total use of water in the United States, excluding hydroelectric power generation. The large single use of ground water is for irrigation, which in 1985 accounted for about 48 billion gallons per day. It is important to note, however, that while such irrigation represents the largest withdrawal, roughly half of the population of the country relies on ground water for domestic supply. Some of the factors responsible for the decrease in irrigation use include a doubling of energy costs in 1979 which made pumping more expensive, an unusually wet period in the western states during 1983-1985, and a decline in commodity prices that makes irrigated agriculture less economical.

A map of major aquifer systems in the United States is shown in figure 2. Some characteristics of the various systems depicted on this map are summarized in the following paragraphs.

The Central Valley of California has been the most heavily pumped contiguous irrigated area in the country. It appears that more than three quarters of the water that has been pumped in the Central Valley over the years has been derived from recharge, or reduced natural outflow; and the system seems to be roughly at equilibrium at present. However, the withdrawals from storage that have occurred in the Central Valley are significant, in that, as previously noted they have been accompanied in many areas by severe land subsidence. With proper management, ground water can continue to be used conjunctively with surface water in the Central Valley; and short-term withdrawals of ground water from storage, particularly in times of drought, continues to be a viable management option. Indiscriminate increases in pumping rates, on the other hand, leading to sustained withdrawals from storage, would probably generate a resumption of large scale land subsidence.


PRODUCTIVE AQUIFERS
AND WITHDRAWALS FROM WELLS
Compiled by U.S. Geological Survey
ATLANTIC OCEAN
PACIFIC OCEAN
UNCONSOLIDATED AQUIFERS
CONSOLIDATED ROCK AQUIFERS
WITHDRAWALS FROM WELLS
U.S. DEPARTMENT OF THE INTERIOR

The Ogallala Aquifer of the High Plains has been extensively developed for irrigation, particularly in its southern segment, in west Texas and New Mexico. The aquifer actually covers parts of eight States--Nebraska, Kansas, Oklahoma, Colorado, Wyoming, and South Dakota, in addition to the two mentioned above. Viewed in that regional context, however, only about five percent of the water that was originally present in the Ogallala Aquifer has been removed by pumpage. In the northern parts of the system, where pumpage is less intense and recharge more plentiful, the impact of development has been light. In the Southern High Plains, on the other hand, recharge is small, and virtually all of the pumpage has been supplied by withdrawal from storage. The resulting decline in water levels has been severe in some localities, causing loss of well production, and threatening local exhaustion of an economical supply over the next 20 to 40 years. Management options here undoubtedly include improvements in irrigation efficiency and possibly in well-field design, to extend the life of the aquifer.

The carbonate aquifers of the Florida peninsula have been extensively developed, both for irrigation and for municipal supply. The aquifers are highly permeable and heavily recharged; the system appears to adjust rapidly to a new equilibrium after each increase in pumpage. Current estimates are that total pumpage represents about 10 percent of the natural flow through the system. Local problems of saltwater encroachment exist; but in many areas, freshwater extends seaward for many miles beneath the ocean. Sinkhole development is frequently a feature of limestone terrain whether ground water is pumped or not; it is possible, however, that pumpage in Florida may have accelerated the process slightly in a few localities. The nature of the limestone permeability is such that relatively rapid movement of contaminants is possible; thus, the management of waste disposal is a major concern in development and use of the aquifer system. Despite the problems which exist, the overall outlook for expanded development of the limestone system appears to be excellent.

In the Northern Great Plains area (States of Montana, North Dakota, South Dakota, Wyoming), the Dakota Sandstone and other relatively accessible aquifers have been developed extensively for irrigation. Development of coal resources in this area has generated a new set of competing water demands, and interest is currently focused on deeper relatively undeveloped aquifers, such as the Madison limestone, as possible sources of supply.

In Idaho, the basalt aquifers of the Snake River Plain are among the most prolific in the Nation, helping to sustain a vigorous irrigated agriculture. Further west, the basalt locks of the Columbia Plateau, while less productive than those of the Snake River Plain, are important sources of water with great potential for further development.

The Atlantic Coastal Plain, from Long Island to Georgia, is an area underlain by unconsolidated sands and clays, in which the sand intervals generally function as very productive aquifers. A great deal of development for urban and industrial use has taken place, and millions of people in this area rely on ground water for domestic use. Overall, the pattern of development has involved successive increases in pumpage, each accompanied by a period of storage withdrawal, followed in turn by adjustment to a new equilibrium. There is some evidence of minor local land subsidence associated with the storage withdrawal, and contamination of the aquifers in some urban areas has been a major concern.

In the alluvial basins of Nevada, Arizona, and New Mexico, ground water has been a primary source of irrigation and municipal supply for many decades. In many areas, it represents the only available source of supply. Extensive withdrawal from storage is commonplace, and competition for water between irrigators and rapidly growing municipalities is becoming an increasing matter of concern.

The Mississippi Embayment-Gulf Coastal Plain area, covering parts of Texas, Louisiana, Mississippi, Tennessee, and Arkansas, contains a vast complex of unconsolidated sediments in which many of the sand units are excellent aquifers. Development for irrigation and municipal supply has been extensive; local problems have included accelerating declines in ground-water levels, land subsidence, and local contamination from surface disposal of oil field brines and other waste liquids.

In the glaciated valleys of the northeastern states, development of ground water has been primarily for domestic, municipal, and industrial supply. The aquifers tend to be of limited extent, and are commonly well linked to a local stream system, so that withdrawal from either source influences the other. Conjunctive management of ground water and surface water is required in management of the resource. Contamination is the major problem facing the area, and movement of contaminants between the ground-water and surface-water systems is a primary concern.

The aquifer systems of the upper midwest States of Minnesota, Wisconsin, Iowa, Missouri, Ilinois, and Indiana include glacial deposits, sandstone, and carbonate units which have been widely utilized for domestic, municipal, and industrial supply, and which are being increasingly utilized for irrigation. Extensive pumping in the Chicago and Milwaukee municipal areas has resulted in widespread declines of artesian water levels in the region around and between these two cities. Contamination problems have appeared in many localities.

## QUALITY OF THE NATION'S GROUND-WATER RESOURCES

Although we have a well developed understanding of the quantity of our ground-water resource, we have relatively little information on its quality, especially regarding toxic contaminants. This lack of information is due largely to the invisibility of the resource, to the fact that large segments of the resource remain undeveloped, and to the difficulty and expense of obtaining and interpreting meaningful data. Our ground-water quality information, especially with regard to contaminants related to human activities, tends to focus on small problem areas of a few square miles or less where contamination has jeopardized or prevented intended uses of the water, and to newly emerging information with more widespread non-point contamination related to agriculture and other phenomena.

The quality of ground water can be degraded by both natural processes and human activities. Natural causes of quality degradation include mixing with saline water and leaching of toxic elements or compounds from minerals and rocks. Although naturally poor quality ground water can be found virtually anywhere if one drills a deep enough well, mankind's impacts on ground-water quality are emphasized in the following discussion.

Ground-water contamination, which has been termed "the environmental issue of the 1980's," is not a new phenomenon of the past decade or two. People have undoubtedly been plagued, literally, with contaminated ground water for millenia. Documented cases date back centuries. People, their wastes, and their water supplies constitute one of man's eternal triangles; where one is, the other two are almost always present.

However, the problem is a growing one--more and more ground water is becoming contaminated. We have also become increasingly conscious of our water quality. The problem of ground-water contamination is worsening, or appears to be worsening; first of all because we are looking harder for contamination and finding it. Secondly, we are developing more ground water each year for drinking-water supplies and other uses. Thirdly, we have been generating more and more toxic-waste products per capita each year. Fourthly, it takes many years for contamination to spread in ground water and we are now reaping the fruits of our actions over the past century or so. Finally, we are simply more interested, aware, and concerned about environmental problems than we were 20 years ago, so that contamination problems like Love Canal and Valley of the Drums make front-page news.

Because of the invisibility and complex nature of the ground-water resource, we do not know how much, or how badly, it is contaminated. It has been estimated, however, that probably only a few percent of our potable shallow ground-water supply is contaminated, based on quantities of waste generated and numbers of disposal, storage, and spill sites.

It is clear then, that most of our ground water, 95 percent or more is uncontaminated by human activities. The problem is that much of the contamination occurs where the people and their drinking-water supplies are. Also, it is important to keep in mind that much of the Nation's readily available potable water is ground water, and that one-half the population of the United States relies on ground water for domestic supply.

The chemical and biological degradation of our ground water has resulted from a variety of sources including approximately 7,000 known hazardous-waste disposal sites, 180,000 other chemical sites and impoundments, 200,000 municipal landfills, and countless septic tanks, disposal wells, leaks and spills. Septic tanks alone discharge 800 billion gallons of effluent to our ground water per year.

The drinking-water supplies of a substantial number of people in places like Long Island, New York; St. Louis Park, Minnesota; Barstow, California; and hundreds of other communities have been lost in recent years due to ground-water contamination. It is clear that the problem is a large one that promises to get worse before it gets better.

Although industrial toxic-waste disposal sites such as Love Canal, New York, are significant sources of contamination, the Environmental Protection Agency (EPA) ranks ground-water pollution sources in the following order: (1) septic tanks, (2) petroleum exploration and development activities, (3) landfills and dumps, (4) agricultural practices, and (5) waste piles, sumps, and lagoons.

Citizens and small businesses are often collectively large contributors to local contamination problems by their discards to trash cans or discharges to the ground (pesticide containers, crank case oil, organic solvents, petroleum fuels, etc.).

Toxic contaminants include hundreds of inorganic and radioactive elements and compounds, tens of thousands of organic compounds, and numerous bacterial and viral micro-organisms. Among the most commonly occurring toxic contaminants are nitrate, heavy metals, polynuclear aromatic hydrocarbons (from petroleum fuels and coal tar derivities), trichloroethylene and related solvents, pthalates, toluene, and benzene.

The behavior and fate of contaminants in ground water is governed by a complex mix of interdependent physical, chemical, and biological processes. Physical processes include ground-water flow and dispersion of the contaminant, evaporation, filtration, and bouyant and phase separations. Major chemical reactions include chemical solution and precipitation, hydrolysis, oxidation and reduction, complexation, ion exchange, and sorption. Microbiological effects involve decomposition, cell-synthesis, and a number of other processes that are not well understood.

Although we know something about all these processes, our knowledge is inadequate to make quantitative assessments or predictions of contaminant behavior and fate in most real world systems. We are in need of developing better sample collection and handling techniques and methods for determining key parameters in the field for nearly all the above processes. Considerable effort is needed to understand the relative importance of these processes to the point that we can develop simplified models. Also, demanding attention is better monitoring technology and enhancement of indirect sensing techniques such as surface-geophysical methods.

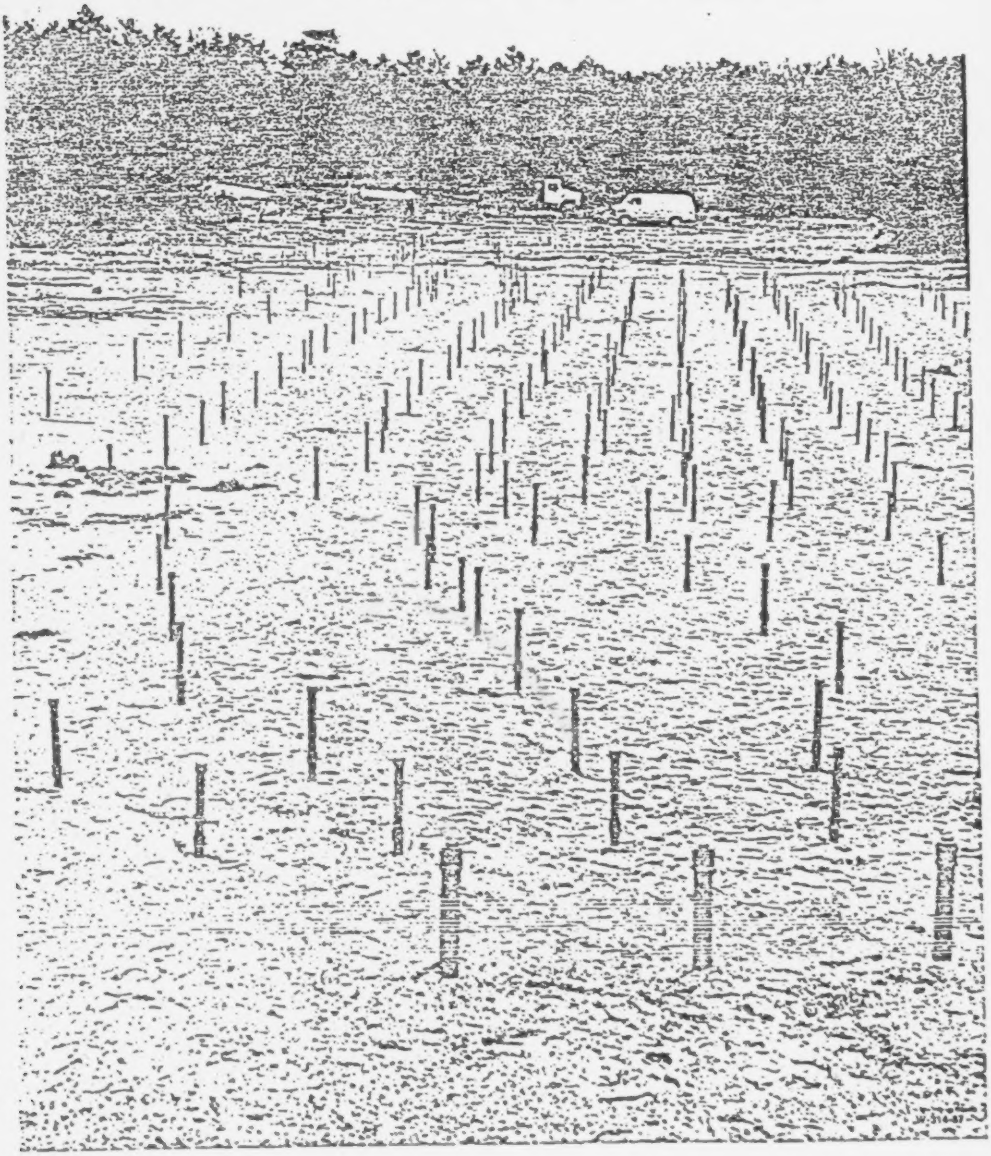
Among the principle difficulties attendant to the ground-water contamination issue are the following:

The distribution and magnitude of contamination - Little is known about prevalence of toxic substances in ground water at the national scale, although much information has been developed, especially in recent years, at individual sites where contamination is known to occur. A principal problem is that we have no underlying theory that will allow interpretation between known points of contamination so as to predict whether contamination occurs between those points - in constrast, given two water-level measurements and a knowledge of the aquifer medium, the hydrologist can quickly predict water levels between the points of measurement. No such capability exists in the case of contamination, and the only apparent alternative in providing a national picture would be sampling a prohibitive number of wells throughout the 3-million square-mile area of the country. A second problem is that, at a practical level, it is not possible to analyze a water sample for all possible contaminants - judgments must be made as to what substances to look for, and what laboratory analyses to be performed; limited by that cost-imposed practicality, it may never be possible to declare that water is totally "clean."

The geologic controls, and the chemical, physical, and biologic processes that govern the movement, alteration, and ultimate fate of toxic substances in ground water - Research on these processes are vital to develop an understanding of where a contaminant goes after it is introduced into the ground-water system, at what rate it travels, and what transformations occur that affect its toxicity and longevity. Such research is being undertaken at an accelerating rate, but it is very time-consuming and expensive. As an example of an experiment designed to develop information on the physical mechanisms that control dispersion and the rate of contaminant in a heterogenous aquifer, the attached photograph shows a portion of a test plot where 640 wells have been installed to monitor the movement of tracers. Each of the wells has 15 ports, extending to depths of 15 to 20 feet below the water table, from which water samples can be obtained, thus providing information on the vertical distribution of the tracer as well as its areal distribution. Over the 20-month duration of this study (which is continuing), about 100,000 water samples have been collected that when fully analyzed will yield a three-dimensional picture of solute transport from a point source.

While it is clearly evident that much research is needed to identify the processes that control the transport and fate of chemical constituents, what is often not so clear is that our ability to define the physical characteristics of aquifer systems is generally not sufficient to predict the velocity of ground-water flow, the dispersion of solutes as the result of subtle deficiencies in aquifer properties, or the degree of solute retardation as the result of interaction between the solute and the rock matrix. Field-scale experiments of the sort described above are essential components of

# OBSERVATION AND SAMPLING WELLS, CAPE COD, MASSACHUSETTS



the needed research, but multiple approaches will be needed to address these problems. On the one hand, theoretical development and laboratory experiments can provide insight into the fundamental processes that are operating, and on the other, field studies can provide direct observational evidence of the effects of hydraulic or chemical stress on the system. The link between these two activities is often computer simulation, wherein the products of theoretical development are incorporated in mathematical models that can be tested against the observational results of the field studies.

Containment of ground-water contamination and aquifer remediation - Can contaminated ground water be completely cleansed? In most cases, the answer is probably no. However, this is another area about which we know little. In some circumstances, it has been demonstrated that microbial decomposition of some pollutants such as gasoline can be artifically induced or stimulated in the subsurface. Other remedial actions with varying degrees of effectiveness include low-permeability grout curtains, physical removal, and chemical treatment. However, in virtually all cases it will be much easier, cheaper, and more effective to prevent contamination than to clean it up.

Information and Research Needs - Possibly no other national environmental concern has the complex intermix of unknown properties and processes as does the problem of ground-water contamination. Many, if not most, of the 225 chemical, biological, and radioactive substances that have been detected in ground water have poorly defined physical and chemical properties, and they can occur over a wide range of climatic zones and in natural waters of highly diverse temperatures, chemistry, and pressures. Accordingly, the solubility, chemical reactions, and physical properties of these compounds cannot be expected to remain constant over the range of environmental conditions that may be encountered. In addition, there are thousands of other anthropogenic compounds that are potential ground-water contaminants. A full analysis of the ground-water contamination problem would require knowledge of a closed loop of activity, starting with the point at which the contaminant is applied to land surface, followed by transport through the unsaturated zone to an aquifer, dispersion and transformation within the aquifer(s), discharge to surface water or to pumping wells, and ultimately, injestion by people. Each of these components has attendant information and research needs.

At land surface - As discussed previously, contaminants are superimposed on a pre-existing ground-water flow system, and the kind, concentration, and rate of introduction of contaminants is the source term that is required for all subsequent analyses. Information is needed on the geographic location of contaminant sources, their physical and chemical characteristics such as density, solubility, and reactivity, and their concentration. Additionally, information is needed on precipitation and the net recharge that is available to move contaminants through the soil and unsaturated zone to the water table.

Movement in the saturated and unsaturated zones - Information is needed on the character and thickness of the unsaturated zone, and the degree to which it can immobilize or sorb contaminants. Within the saturated zone, a knowledge of the pre-existing flow system is needed, encompassing the geology and physical characteristics of the aquifer medium as well as the geometry of the system and its areas of recharge and discharge. In addition, the chemistry of the aquifer water must be known. Once contaminants are introduced into the flow system, dispersion will occur in proportion to the velocity of ground-water flow and the heterogeneity of the aquifer fabric. The contaminant plume will also be affected by interactions with the aquifer material, with the result that contaminants will move at velocities that differ substantially from ground-water velocities. Considerable research is needed in that area to define both where the contaminant will be transported and at what rate. Lastly, there is the problem of the persistence of the contaminants, and the manner in which they are altered by chemical, physical, or biologic actions. Given the range of temperatures, pressures, and reactivities of natural waters, predictions of the alternative and fate of contaminants in the subsurface environment poses formidable problems. Research on these problems will require coupled field, laboratory, and theoretical investigations, and will depend heavily on observations made in situ.

Return to land surface - Ultimately, almost all fresh ground-water discharges at land surfaces, either by natural flow paths or by pumping from wells. Contaminated ground water is then available for injestion by humans, and it seems evident that much research is needed on the toxicologic effects of a broad range of contaminants, and the risks associated with human consumption.

Senator **Bradley**. Before we go to Mr. Cohen, I would like to ask you a couple of questions, Mr. Frederick.

You said what percent of your budget is related to groundwater?

Mr. **Frederick**. About half of our Water Resources Division budget is related to ground water, both ground-water quality and ground-water quantity. That would probably be on the order of just under 20 percent of the total Geological Survey budget.

Senator **Bradley**. And that is about $140 million appropriated——

Mr. **Frederick**. There is about $140 million appropriated for water resources. There is an additional $50 million to $60 million that comes from State and local government agencies.

And the remainder of the total of $267 million for our water programs comes from other Federal agencies.

Senator **Bradley**. Now, the fiscal year 1988 budget request was somewhat less?

Mr. **Frederick**. The fiscal year 1988 budget request was a bit less. I believe about $15 million less.

Senator **Bradley**. Yes. Is that going to be a problem?

Mr. **Frederick**. Well, in designing that budget, we tried to pay attention to all of the priority issues——

Senator **Bradley**. So the answer is no.

Mr. **Frederick**. Of course there are problems. But we tried to minimize those problems when we designed the budget. We understand the tough budget situation the country is in at the moment. And we tried to design the budget so that we could respond to the high priority issues even with a slightly reduced budget.

Senator **Bradley**. Okay. Why do we not proceed with Mr. Cohen, and then we will come back with questions for both of you.

Let me welcome Mr. Cohen to the committee. I have had the pleasure of talking with you on a previous occasion. And I think that there is probably no one in government that knows as much about water as you do.

I think that everyone present will find this an extremely informative presentation. Hopefully we will get into some questions.

## STATEMENT OF PHILIP COHEN, CHIEF HYDROLOGIST, U.S. GEOLOGIAL SURVEY, DEPARTMENT OF THE INTERIOR

Mr. **Cohen**. My presentation this morning will be based largely on the briefing boards that you see here before you. The first board depicts the major water problems in the Nation, at least from the perspective of the hydrologist.

These problems are as follows: ground-water contamination (and, as you indicated, many of these problems are interrelated or closely related to ground water, some more and some less);

Issues of high- and low-level radioactive waste disposal (the principal concern is the impact on ground-water systems); acid rain (which can in fact impact ground-water systems indirectly; energy and mineral resource development (the requirement for water to develop these materials and in turn the impact of developing these materials on water supplies, both surface water and ground water);

The issue of water supply (One that the Geological Survey has been concerned with for more than 100 years, is still a very major issue around the United States. It does not get the attention that some of these other issues get, but by and large many of our cooperators are deeply concerned about making sure they have an adequate water supply.);

Flood hazards, and droughts. We do a great deal of work with quantity and quality of surface water, rivers, lakes, estuaries, and finally volcanoes. (Mt. St. Helen's had some very dramatic and adverse impacts on the hydrologic regime of the surrounding region which, incidentally, included impacts on ground water.

Many of these impacts were life-threatening. The Geological Survey played a significant role in both the volcanology and the hydrology, at Mount St. Helens, and we are doing some reconnaissance work on other potentially eruptive volcanoes to try to determine what the hydrologic impact and, therefore, what the threat might be to life and property.)

With regard to ground water, we have conducted probably more on the order of thousands, of individual investigations throughout the country during this century. A major new effort on the part of the Geological Survey began about a decade ago.

We refer to this effort as our Regional Aquifer Systems Analysis program. This program was initiated in large part on the basis of interests by the House Appropriations subcommittee, in the mid-1970s, in looking at ground water as an alternate water supply in the midst of a rather severe drought at that time.

And under the direction and stimulation of that subcommittee, we came forward with some proposals to bring together much of the available ground-water quantity, and some of the available ground-water quality information on a regional scale, covering most of the major aquifers of the United States.

At the time that this program was developed, the state of the art in evaluating ground water had evolved to the point where powerful digital computers were available and complex mathematical expressions of the physics and chemistry of these aquifers could be brought together in simulation models.

We could make quantitative statements about most of the major aquifers in the United States, and those quantitative statements have proved to be of value to water managers and policymakers.

And that quantitative framework, at least from a regional and national point of view, is a reasonably effective one into which additional water-quality issues can be incorporated.

Senator **Bradley**. If you could, before you leave that map, is the map that you have shown the committee essentially an aquifer map of the United States?

Mr. **Cohen**. In gross aspect, yes, sir. We have shown here 28 of the major aquifer systems in the United States. And at this scale, that covers probably about 90 or 95 percent of the ground-water that is now being developed and will be readily developed.

Senator **Bradley**. So that when you see the Atlantic Coastal Plain, for example, in New Jersey, that includes the Cohansee aquifer, as well as other aquifers along the coast as you proceed south. Is that correct?

Mr. **Cohen**. That is correct.

Senator **Bradley**. But you are saying, they are essentially all part of the same structure.

Mr. **Cohen**. In a sense. The Coastal Plain of the southeastern United States extends from Long Island southward to the Mississippi Embayment and terminates in the southwestern portion of Texas.

These are all unconsolidated coastal sediments which look, in gross aspect, very similar. In New Jersey these thick unconsolidated sediments, which dip seaward, are partially marine sediments, partially sediments deposited on shore.

These materials do vary in terms of depositional mode and nature, but by and large they form one massive wedge of sedimentary deposits.

Senator **Bradley**. What is the relationship between the various aquifers? For example, between Great Basin in Nevada and Utah, and San Juan and Southwest Alluvial? Are they different levels, different depths?

Mr. **Cohen**. For practical purposes, the aquifers are virtually separate. In the particular cases you mentioned they are both virtually totally separate. They represent different geologic environments, different rocks.

The hydrologic regime in each of these various places is, for practical purposes, separate. They come together only in the grossest aspect of the hydrologic cycle. They are all subject to evaporation and ultimately moisture gets into the atmosphere. But that is a tenuous relationship.

Senator **Bradley**. So that essentially they are like totally different entities. Like different islands in the geological strata.

Mr. **Cohen**. For most purposes, yes, sir. Or, for developmental purposes, policy formulation purposes, except at the grossest national scale, they can be considered separate.

The other point that needs to be made, although these sediments are physically in continuity with one another, it is inconceivable that anything anyone would do in the northeastern portion of the Atlantic Coastal Plain would have any impact whatsoever on the southern portion of the Coastal Plain. Although they are physically in continuity with one another, for practical purposes they are just as discontinuous as these isolated aquifers.

The color scheme depicts the status of our work. The orange indicates areas where we have completed our work. The blue indicates studies that are now underway, and that will be completed in the next several years, or which are about 80 percent finished.

The next board shows the usage of ground water from 1950 through 1985. It is clear that the dominant component of total usage is withdrawal of ground water for irrigation. The top red line shows total uses, which is the sum of irrigation, rural supply, public supply, and self-supplied industrial.

Clearly withdrawals for irrigation dominate the total amount. In gross aspect, ground water withdrawals increased from about 35 billion gallons per day in 1950 to about 78 billion gallons in 1985.

You will note that total withdrawals apparently began to level, during the period of 1975 to 1980, and then there was a decline from 1980 to 1985, which just about mirrors the changes in withdrawals for irrigation purposes.

During the same period, however, the use of ground water for public supply increased threefold, from about 5 billion gallons per day in 1975 to about 15 billion gallons per day in 1985.

Rural use also increased significantly, although on this scale it is hard to demonstrate the slope of the line. Industrial use seems to have mirrored the downturn in irrigation in the period 1980 through 1985.

Senator BRADLEY. Now, why did irrigation drop between 1975 and 1985?

Mr. COHEN. The most likely factors are as follows. Number one, it was a fairly wet period toward the end of the 1970s. For many irrigation projects throughout the West the source of water for irrigation is a combination of both ground water and surface water.

Normally ground water is the more expensive of the two, because it requires pumping, and that in turn requires energy. With increased precipitation, there was apparently less need for irrigation water.

So we believe that that was one of the major factors. The initial decrease would have been ground water, because that would have been the most cost-effective way to manage conjunctive use.

Second, during the 1970s and early 1980s the cost of energy rose dramatically, and again energy is a major factor in withdrawing ground water. We believe that economic factors strongly impacted the amount of ground water that was withdrawn.

Third, just about concurrent with the increase in energy, there was a significant decrease in the value of irrigated crops. Ground water is the most expensive way of providing irrigation water.

We believe that these three factors operating together were probably the cause of most of the decline evidenced in ground-water withdrawals from 1980 to 1985.

Another way of depicting the pumpage of ground water is shown on this briefing board. The amount of ground water withdrawn is shown by various sized circles and is proportional to the size of the circles. The larger the circle, the larger the amount of ground water. The units are shown on the ledger, and they are really not too important. You can see that the largest withdrawals of ground water are in Central Valley, California. The Central Valley project is one of the largest irrigation projects in the world using ground water. And with regard to the United States, it is the largest irrigated acreage in terms of dollars, as well as in terms of withdrawal of ground water, something on the order of a $20 billion per year agricultural economy which is dependent about 50 percent on ground water and 50 percent on surface water for irrigation in the Central Valley.

The second largest development of ground water is in the so-called High Plains Ogallala aquifer, where you note the fairly large, almost solid blue circles representing heavy pumpage of ground water. This region also represents a multi-billion dollar irrigated economy.

Other areas, just two others, I will point out that are of note. The Snake River Plain has long been an area of heavy ground water development in Idaho. It too supports a very viable irrigated agricultural economy.

There is also heavy pumpage of ground water in Arkansas that has been going on for a long time to support a rather substantial irrigated rice crop economy.

Now, one of the things classically that water scientists direct their efforts toward is trying to understand the occurrence of ground water and its availability, and trying to monitor and predict how hydrologic systems will respond to pumpage.

As a general rule, all other factors being equal, the more one pumps the more ground water levels decline. The next map attempts to depict that on a national scale in a very crude way, because we had to generalize.

Again, in order to be able to put this on a national scale, we elected to depict where ground-water levels have declined 40 feet or more. The heavy pumpage in the Central Valley of California is reflected by significant drawdowns——

Senator BRADLEY. This is in what period of time?

Mr. COHEN. This is historical pumpage. So roughly, we have averaged data. We are roughly looking at about a 70 or 80 year period.

In some cases it is more than 100 years of pumpage. In others it is fairly recent.

Senator BRADLEY. So the aquifer is 40 plus feet lower than it was before when?

Mr. COHEN. The water level in the aquifer is at least 40 feet lower than it was under natural conditions prior to development.

This map attempts to show what level of declines have occurred since development. The period of development is different from place to place.

So we have substantial declines in California, and these incidentally were associated with and caused land surface declines or subsidence, which can be very disruptive and cause very costly damage to irrigation structures and other structures.

Significant declines have occurred in the Chicago-Milwaukee area, as a result of very heavy pumpage. Again, in the Chicago area, since the middle of the last century, ground-water pumpage has resulted in declines in water levels of as much as 800 feet below the normal pre-development level in some locations.

Significant declines have occurred along the Coastal Plain, especially in New Jersey and southward, parts of Maryland and Virginia, and some significant declines in the Texas area. In these particular cases, when these declines occur, ground water is in equilibrium with salty ground water, which in turn is connected to the sea.

As ground-water levels begin to decline, salty ground water begins to move inward. This has been a subject of concern and considerable investigation for a long period of time, in terms of how to effectively manage that ground water.

Senator BRADLEY. Why is the decline so great in South Dakota?

Mr. COHEN. This represents several factors. Although they are not unique throughout the United States, they are somewhat unique in terms of the scale of the phenomenon occurring here.

South Dakota is underlain by the so-called Dakota Sandstone, a very widespread aquifer, which dips fairly gently from west to east and outcrops along the foot of Rocky Mountains.

Most of the water enters the aquifer along the foot of the Rocky Mountains at a fairly high elevation and flows eastward to the point where, beneath South Dakota, the aquifer is at great depth. It is confined by overlying materials and is under artesian pressure.

Early settlers began to explore for ground water, drilled deeply into this aquifer, and the wells began to flow. Flowing wells are economically very attractive phenomena, because they require no pumping. They require little maintenance. The water will flow, it will not freeze, because ground water has a fairly constant temperature.

A very large part of the agricultural economy in South Dakota, beginning about the turn of the century, was based upon these flowing artesian wells. The wells were allowed to flow freely.

As a result, the artesian heads, which initially were more than 100 feet above land surface, have declined over a very wide area. This is due to the fact that they are artesian and have been flowing for a long period of time, and the fact that artesian pressures and changes in pressures tend to disperse themselves very widely.

Senator BRADLEY. So you are saying that 100 years of artesian wells have caused it to drop.

Mr. COHEN. Free flowing artesian wells. That is correct.

Senator BRADLEY. What about in Chicago?

Mr. COHEN. It represents largely pumpage for the greater Chicago metropolitan area and pumpage for many of the municipalities immediately east of Milwaukee.

Milwaukee gets almost all of its water supply from Lake Michigan. Chicago gets a significant part of its water supply by Lake Michigan.

But withdrawals from the lake are limited by a Supreme Court decree, which came about as a result of a lawsuit between and among the various States, with Canada acting as a friend of the court. That lawsuit puts an upper limit on the amount of surface water that Illinois can withdraw from Lake Michigan.

Illinois therefore has had to depend upon the fixed amount of the water that it can withdraw from the lake, plus available ground water.

Senator BRADLEY. So that the amount of ground water is a result of the court settlement.

Mr. COHEN. That is correct. I suspect if the Chicago metropolitan area were given a free hand, they would prefer to use surface water, because it is less expensive.

Senator BRADLEY. They would what?

Mr. COHEN. If Chicago were legally given a free hand to choose the source of water supply, they would undoubtedly select the lake, simply because it is less expensive to withdraw water from the lake than it is to pump ground water from great depths.

Senator BRADLEY. What about the relatively current phenomenon of the lakes increasing in depth? Is there not reason now to go back and look at that court order?

If the concern was that if everyone taps the lakes, there will not be any lake, the lakes are rising now.

Mr. COHEN. Chicago is now pumping, I believe, something on the order of 400 cubic feet per second from the ground, and withdrawing about 1,600 cubic feet per second from the lake for public supply water.

If Chicago were to completely abandon its ground-water pumpage, it would take an additional 400 cubic feet per second from the lakes which would have no measurable impact on the levels of the lake.

The volume of water in the lakes is so great, and the volume of water involved in this recent rise in lake levels is so great that a shift totally to withdrawing water from the lake would have no measurable impact on the lake.

Senator **Bradley**. So what was the rationale for the court order?

Mr. **Cohen**. The concern then, and there is a lot of concern now, both in the Congress and among State and local people, is to protect the integrity of lake levels in perpetuity. That concern still exists. There are many Members of the Senate and Congress who take a very strong position and have for many, many years, been opposed to inter-basin transport of water; that is, taking water from the Great Lakes and moving it out of the drainage basin of the Great Lakes.

Superimposed on that concern is, as you imply, these fluctuations in lake levels, which are natural and which have occurred before in the geologic past, are occurring now, and will occur in the future.

Incidentally the Geological Survey is studying the problem and has for a long time. I understand in the markup in the House yesterday there were some additional funds added to continue to study these natural lake level fluctuations.

Senator **Bradley**. At this point, let me just interrupt, Mr. Cohen. Senator Ford, do you have any comment or opening statement?

Senator **Ford**. No. I think the phenomenon we are talking about here, you asked that question, the lakes are rising, what, two feet now? Or more? Or somewhere along there.

And why we could not be using that. So you got into that. It seems to me if there is no appreciable difference, why not save money and go ahead and use the lake water. We are using 3 to 1 now.

Mr. **Cohen**. Someone may decide to bring that issue to the Supreme Court. At least that is one avenue to address the issue.

Senator **Ford**. We will see how the Supreme Court reacts. Thank you, Mr. Chairman.

Senator **Bradley**. Senator Evans, do you have any opening statement or comments that you would like to make?

Senator **Evans**. Well, only that I will be interested as we proceed with testimony this morning in what appears to me to be the obvious.

We are seeing ground water level declines in many areas of the country. A very large share of water usage in percentage, in volume is for irrigation purposes.

It seems to me that one of the most important things we could be doing as a nation, both in order to sustain ground water levels and quality and to sustain an appropriate level of agriculture, is to move aggressively and firmly on behalf of either water conservation, or figuring out how to get the same value, or maybe even better crop results, and doing it with a lot less water. People in other parts of the world, I think the Israelis in particular, are very, very good at getting a lot out of a little.

Ironically, in our part of the eastern part of the State of Washington, where irrigation is a very big factor, where we have hundreds of thousands of acres under irrigation, the end result of that irrigation is the problem of drainage and of seepage.

It is excess water, which is applied to crops that comes down and creates terrible problems in the low spots. I just do not detect that we have moved very aggressively in this arena.

I would be happy to hear any testimony that would indicate that I am wrong, or any ideas as to how we might move more aggressively in that area.

Senator BRADLEY. Thank you. Mr. Cohen, you may proceed, and keep in mind the comments of the various Members during the course of the testimony, Mr. Frederick and Mr. Cohen.

Mr. COHEN. In addition to having a physical impact on ground water levels, that is, pumpage causes ground water levels to decline, the Nation is concerned, and correctly so, with impacts on the chemistry of ground water. There is much concern now throughout the entire Nation and the Congress.

This board attempts to depict some of the major causes of so-called point sources of contamination, where the source of the contaminant entering the ground water is a very small point, as opposed to non-point which we will talk about later.

This board shows beds of sand and gravel overlying hard rocks, such as shale and sandstone, a generalization of what the earth might look like. These materials are saturated up to a level that is called the water table. Everything below that level is ground water.

And note that the ground water is connected to the surface water. If you impact one you are going to impact the other. Also shown are disposal ponds. This was the common way of disposing of many of the Nation's wastewaters throughout the history of the country.

Senator BRADLEY. What is a disposal pond?

Mr. COHEN. A disposal pond. People would simply dig a pond, an industry or a homeowner or a municipality, and dispose of wastewater in the pond.

This is still ongoing in the United States, as a matter of fact. Water leaks through the ponds to the water table——

Senator EVANS. I might say to the Chairman that was a common way of disposal on the Hanford reservation early on of many fairly potent nuclear wastes.

Mr. COHEN. That is correct, sir.

Senator EVANS. Put them in ponds with no lining, and seepage just went down into the hundreds of feet——

Senator FORD. Oil wells, salt water disposal, generating facilities, paper mills.

Mr. COHEN. That is correct.

Senator EVANS. It gets a little scary when it is radioactive.

Mr. COHEN. And a term that you will hear associated with this phenomenon, it has become part of our jargon now, and it shows up in the media, is the term "plume."

There are plumes of contaminated ground water, which move slowly through the fresh ground water. The board also shows another small plume, in this particular case associated with accidental or intentional spills or leaks.

Buried wastes also result in plumes of contamination. Our colleagues from the Environmental Protection Agency are deeply involved in some major programs associated with this phenomenon, which I believe they will discuss.

Deep well injection has been a very widespread practice throughout many parts of the United States. It has been a common way of disposing of oilfield brines and it has also been used to dispose of some highly noxious and toxic substances. It can be used to dispose of municipal wastewater. It is not nearly as widespread and as common as the disposable salt water brines from oilfields. But there is a substantial amount of this, and our colleagues from the Environmental Protection Agency have a principal responsibility for regulating this practice.

So these are some of the major point sources of contamination. I might also add that it is important to keep in mind that ground water flow rates are orders of magnitude slower than surface water flow.

Water moves in streams commonly at rates of feet-per-second, whereas ground water moves at rates of feet-per-year or tens of feet-per-year. Only under very unusual circumstances will ground water move hundreds or thousands of feet per year.

Senator BRADLEY. So that the plume, wherever it is, moves feet per year.

Mr. COHEN. That is correct. And in some parts of the country, such as your State, Mr. Chairman, ground water contamination that is now showing up in some wells may have entered the ground 50 years ago. That effects the slow rate at which ground water moves.

Now there are exceptions. There are extremes on both ends, where there is virtually no movement. That is what the nation is looking for in the disposal of high-level radioactive wastes.

Senator FORD. What is deep well injection? What materials are used in that?

Mr. COHEN. Primarily, mostly the brines that are associated with the production of oil and gas.

Senator FORD. Gas, would be a reinjection.

Mr. COHEN. Yes. A phenomenon——

Senator FORD. Would that contaminate? If we bring it from the ground and from particularly that well, and then Canada now and other big oil fields where you are taking oil off and injecting the natural gas, does that create a contamination?

Mr. COHEN. The issue there is engineering design. If the structure is built so that you can be assured that the material is placed in the same reservoir bed from which the gas came, or some other reservoir bed, you can eliminate or at least minimize groundwater contamination.

This is a difficult problem. These pipes are made of materials that corrode. Quite commonly, after a period of decades, the integrity of the structure will fail.

When this occurs you can get some of these brines migrating into shallow aquifers, which are used for water supplies. This is a problem that is spotty throughout the United States, but it is a real problem.

For example, if there should be a rupture in the material placed around the bore hole, the waters could move very rapidly up along the outside of the casing.

Now with regard to non-point source contamination, contamination is associated with widespread activities such as fertilizing for agriculture. Or, in areas such as Long Island, where until two or three decades ago virtually all of the eastern two-thirds of Long Island disposed of its domestic sewage through cesspools and septic tanks.

There were many thousands of cesspools and septic tanks constructed in shallow materials, with water supplies being withdrawn from the aquifer and being returned through septic tanks to the shallow materials. Within a few decades those shallow aquifers became contaminated.

Long Island was fortunate. They could drill deeper for water supplies. But now after 30 or 40 years one can see those plumes beginning to move down deeper and deeper.

So, these are two classic examples of non-point source contamination. There are others associated with industrial and municipal activities.

In order to attempt to detect the status of that type of contamination in the Nation's ground water, we have looked at nitrate, one constituent which can be toxic under some circumstances, and has been known for many, many decades to be toxic; therefore, the one constituent about which the Nation probably has the most information.

Health departments and related agencies have been looking at nitrate in potable water supplies for at least the last 50 years.

So again, just to get a crude handle as to what the nature and extent of ground-water contamination might be nationwide, we used nitrate, because there is an abundance of data on this constituent. We did some computer manipulation, and shown here are the results of examining about 95,000 chemical analyses collected over a fairly wide period of time.

Ideally, we would have liked to collect this information all at one time, so you can be comparing apples and apples. We made a number of assumptions based upon "professional judgment." For the purpose of this analysis, when the nitrate exceeded three units we would be fairly suspicious that what we have observed is above the natural threshold.

We are aware of the fact that nitrate naturally does occur above places, here, there and yon. But from the national perspective, where it occurred above three miligrams per liter, we would be suspicious that we were looking at contamination.

We then manipulated the data on a county by county basis, and this is a rather crude depiction that we came up with. We note that the High Plains Ogallala aquifer, which I mentioned earlier as being an area of very intensive agricultural activity, based upon this analysis, does appear to have widespread nitrate enrichment or contamination.

You see the same trends in the Central Valley of California. It is too small for you to see, but all of Long Island is pink, meaning that, using the criteria that we applied for this analysis, we see widespread contamination associated with nitrate in this region.

Nitrate, among other things, is a widely used fertilizer. And in the past several decades, along with nitrate, people have been adding other chemicals chemical such as pesticides.

So this leads to the next level of concern. To what extent do we have pesticide and herbicide contamination associated with this apparent nitrate enrichment due to agriculture? Here the data becomes very, very spotty, because we do not have a record of 50 years of collection data.

We are dealing with compounds that did not exist, in some cases, 10 or 20 years ago. So as a Nation we have a very, very difficult time trying to make statements on regional and national scales about the extent of ground water contamination, certainly with regard to toxic substances like organic compounds and trace metals. The data base simply does not exist.

Senator EVANS. Mr. Chairman, before we put that down, a couple of questions.

First, with respect to nitrate as nitrogen in groundwater, are the tests actually tests to determine the percentage of nitrogen in groundwater?

Mr. COHEN. The chemical analyses are for nitrate, NO3.

Senator EVANS. Okay. So it is specifically of nitrate, not just of nitrogen.

Mr. COHEN. It is nitrate. This is a technical way of expressing it. It could be expressed as units of nitrogen, or it could be expressed as units of nitrate. The numbers would change.

Senator EVANS. Is there not a real difference? You know, 80 percent of the air in this room is nitrogen. So there is a significant difference between nitrogen as an element and the nitrates that may indicate fertilizers in the water. You are clear that this does tell you of the nitrate specifically.

Mr. COHEN. We are looking at nitrate.

Senator EVANS. Secondly, what kind of a national program of well testing can you carry on now? What kind of funding on a regular basis is there, and how extensively can you keep good records?

Mr. COHEN. Most of the well testing that is ongoing in the United States now, and has been ongoing for many, many decades, is done at the State and local level.

Most current testing is done for purposes of assessing the suitability of water for human ingestion or other domestic uses. This testing dominates the data collection, the ground-water quality data-collection programs in the United States.

We have substantial ground-water quality information programs, but they are dwarfed compared to those related to domestic use testing.

Senator EVANS. Is there a central collecting point, or do you receive copies, or records that State and localities keep in this way? In other words, is there any central point where that locally and State collected information is brought together?

Mr. COHEN. There are two major computerized files in the United States. We operate one. The Environmental Protection Agency operates another.

By mutual agreement, we, for convenience of the public provide access to the public to both our files and EPA's files. Our files are largely data collected by the U.S. Geological Survey and State and local cooperators.

EPA's files are much broader. And therein reside, in EPA's files, the largest repository of State and local data.

Senator EVANS. Is there any requirement that States and localities in their well testing program provide that information to either EPA or to you?

Mr. COHEN. I believe if I were to respond I would respond with my understanding of EPA's activities. And if I may I would prefer to defer to them.

Senator EVANS. We will get to them in a little while. And then the final question, how important is it to have a consistent continuing nationwide measuring program that indicates what is in the groundwater?

Mr. COHEN. It is critically important.

Senator EVANS. Okay, well given that it is critically important, is it also important to expand what is tested for beyond, say, just nitrates? You did mention pesticides.

It seems to me that we very likely have sophisticated enough analytical procedures. Is there some fashion, some way that you would suggest that we can help ensure that there is that kind of standardized elements that would give us the kind of information consistently that we need?

Mr. COHEN. There has been a very rapid, continuing, and accelerating rate of activity in terms of analyzing waters in general and ground waters in particular, and many of the compounds that are presently of concern.

Much of that is driven by EPA. The EPA laboratories, EPA researchers and the agencies of State and local governments that interact with EPA are very rapidly building that data base.

We are, in parallel and in close cooperation with EPA, developing and sharing the development of new methods and laboratory and sampling techniques.

From a national perspective, the implication of your question is correct. Much remains to be done. But both agencies are moving pretty vigorously in that area.

Senator EVANS. I guess when we get to EPA, if they remember all these questions, we can get some responses.

I would also be interested in financing, whether out of any of the Federal programs there is financing to aid in this process at local and state level, or whether there should be expanded authority or whether it is sufficiently handled at state and local levels.

Mr. COHEN. Again, it would be inappropriate for me to speak for EPA.

Senator BRADLEY. EPA has noted the questions and will answer them when they testify.

Mr. COHEN. In Mr. Frederick's opening remarks, he noted the Geological Survey's Federal-State Cooperative Program, where we have a joint program of about $100 million per year.

Through that program we are working with some 950 State and local agencies, in part to develop this kind of information.

I mentioned our Regional Aquifer Systems Analysis program. This is sort of our water-quality analogue, which focuses on water quantity and the physics or the structure of the aquifers. The Toxic Substances Hydrology program is one of our major programs looking at water quality of ground water. It has really three major components, one of which we cannot depict on a map. And that is very basic research, both in the laboratory and the field trying to understand processes.

We initiated about 3 or 4 years ago a series of reconnaissance studies—the black dots on the chart indicate where the reconnaissance studies were undertaken—to try to develop methods and demonstrate ground-water quality as a function of human activities, or land use.

After spending a year doing the reconnaissance studies, we narrowed the scope of that effort to six areas where we thought we could achieve the most payoff. These six areas are shown by the green triangles. These are now ongoing.

The studies are attempting to address fairly large areas not individual point sources, and trying to develop the necessary processes and methods of extracting data from the files, developing new data, and beginning to understand how man's activities impact ground water over fairly wide areas.

Regarding point source contamination, plumes, a great deal of money and activity, largely under the aegis of EPA, is being spent on trying to clean up plumes.

We selected six plumes, characterizing some of the most common problems in the country: gasoline spills; a crude oil spill up in Bemidji, Minnesota; heavy metals associated with mining; wood preservatives; creosote and other chemicals.

These represent fairly widespread and important sources of ground-water contamination; trichlorethylene, one of the organic solvents; and finally, sewage at Otis Air Force Base. Common sewage is a major source of contamination.

We have been studying these plumes to attempt to understand the chemistry and the physics—how they move—and how we can develop tools to pass on to those who have the job of concerning themselves with hundreds, thousands of plumes.

The technology that we have developed and the technology under development is designed to make the efforts as cost-effective as possible.

Senator **Bradley**. What are the Whitewood Creek and Belle Fourche studies?

Mr. **Cohen**. Whitewood Creek, the Upper Arkansas River and the Calcasten River, are analogous surface- water studies.

Senator **Bradley**. Say that again.

Mr. **Cohen**. They are surface-water studies that are analogous to our ground water studies.

Current USGS surface water research includes studies of arsenic associated with the Homestake Mine, organics associated with the petrochemical industry, and in the Upper Arkansas, the Silver City mining districts where toxic metals drain from abandoned mines.

These studies are of surface-water contamination analogous to our trying to understand the process regarding ground water contamination.

Senator **Evans**. Do any of your surface water studies carry forward to the deposit at river mouths of what really become beds of toxic substances?

I know that is a particular problem out our way as the rivers flow into Puget Sound. The buildup of these toxic beds at the mouths of rivers when they carry the sediment along and it all drops. Is that under the Corps of Engineers or EPA?

Mr. **Cohen**. We do some of that in the Geological Survey. That is the dominant phenomenon at Whitewood Creek, although this is not; in fact, it is the mouth of the river.

At the Homestake Mine, they have been mining gold for more than 100 years. Associated with the gold is naturally occurring arsenic. The mine tailings have been dumped into Whitewood Creek.

They have worked their way down into the drainage system of the Missouri River, and they are now trapped behind a dam. The entire flood plain of Whitewood and Belle Fourche Creek is made up of the sediments just as you described them.

They may have been deposited 100 years ago, and as the stream cuts back and forth they can rest there for 50 years. However, when the stream channel shifts it erodes the deposits, and they begin to mobilize again.

Senator **Evans**. So the bed has been built up then at the base of the reservoir behind the dam.

Mr. **Cohen**. Right. Now, I simply want to show a cross-section through one plume.

This is the plume at Otis Air Force Base, where the Air Force had been disposing of sewage since before World War II. And they have been gracious enough to allow us to make some very detailed investigations at this site.

That plume is well developed. It is several miles long. As shown here, we have taken one substance, although we have measured many substances. In this case, one of the earliest organic compounds for which studies were conducted is a synthetic detergent a low-foaming detergent.

We found out after the fact, that while it is sort of nice to have that type of detergent, it is not biodegradable. Once it got into the ground it stayed there. So, sometime after this discovery, it was outlawed. We now have a nice tracer in the form of this detergent. We know when it was introduced into the ground and we know when its use was discontinued, when it was taken off the shelves. And we can trace the movement of that plume. And this is what a plume looks like in a little more detail with regard to one substance a synthetic detergent.

Senator **Bradley**. A detergent, a particular kind of detergent?

Mr. **Cohen**. Yes, sir.

Senator **Bradley**. And it got into the sewage.

Mr. **Cohen**. Yes.

Senator **Bradley**. And you could follow that particular detergent, because of its chemical composition, as the plume moved.

Mr. **Cohen**. Yes. In most cases we cannot date accurately when the substance got into the water or when they stopped putting it in.

In this case, we pretty well know, because we know when industry first developed it and we know when it was outlawed. We have been able to follow it.

And by the way, these substances move at different rates. If you look at it, in this particular case, the alcobenzine sulphinate distribution is different than that of nitrate, which in turn is different than some other substances.

You are dealing with very complex problems, which are very expensive to describe in detail, and are of course expensive to remediate. Maybe in some cases virtually impossible to remediate.

Senator **Evans**. Pardon me. Just one question on that.

If you have a similar situation like that, where you are able to identify where all that concentration ends up and it just sits there, sort of percolating in the water table, and it is a chemical substance for which we may find at some point an appropriate way to neutralize it, in your view would it be a potentially useful thing to do to inject the neutralizer into that same plume and have it just for a period of time neutralize the substance?

Mr. **Cohen**. There is a lot of research underway in the academic community, in industry, at the Federal level, to address "methods of remediation."

The methods range from, and this is literally ongoing in some places, physically removing the water—treating it, putting it back into the ground—to introducing chemicals to interact with these substances and neutralize them.

There is a whole range of possibilities. A combination of developing a technically and economically feasible set of alternatives.

In the last board I will describe a new program that we have become involved with over the last several years. In briefings such as this, we have been asked in particular by our House Appropriations Subcommittee, from a national and regional perspective, what can we say about ground-water quality? Can we say whether it is getting better or worse?

We believe that the state of knowledge is such that we can say much on an anecdotal basis—much about a few local points. But there is no overall systematic approach in place to look at multiple parameters on a regional and national scale.

As a result of testimony of this sort, the Congress instructed us to go ahead, and with Administration guidance we are now involved in a series of pilot studies, three ground-water studies and four surface-water studies.

These will be 3 or 4 year studies to test the feasibility of this approach, to determine whether or not this type of approach will be feasible from a national point of view.

Senator **Bradley**. Could you describe the approach?

Mr. **Cohen**. These are detailed investigations in fairly large portions of the United States, much larger than normally addressed.

They cross State lines, in quite a few cases. They are based upon hydrologic boundaries, not political boundaries. The approach is to look in considerable detail at the nature and extent of the ground-water contamination, in part based upon our understanding of the flow system which we have developed over the past several decades, and to make statements about current conditions, and to put in place a process where a decade or so from now one can go back and compare the current condition as we describe it now to the condition that we find 10 years from now.

For a ground-water investigation, for example, if this is determined to be feasible technically, economically and politically, one can envision that after a 3 or 4 year study is complete we would leave behind a network of observation wells. Relationships would be developed with State and local agencies and perhaps other Federal agencies to monitor those wells.

And some entity, the Geological Survey, or perhaps the States, would then have the basis for (a) a baseline, and (b) comparing changes in water quality as a function of time.

Senator **Bradley**. And the surface water, Kentucky River, upper Illinois, what is the basis of choosing that area?

Mr. **Cohen**. These are drainage basins. They are of the approximate size that we envision we would be studying if we had a national program.

We looked for areas having somewhat different types of problems, different types of environments, different opportunities, unevenness in the availability of information, so collectively we can have a fair test:

Yakima's irrigation, Kentucky's mining, and the Upper Illinois, are largely suburban type phenomenon. That completes my presentation, Mr. Chairman.

Senator **Bradley**. Mr. Cohen and Mr. Frederick, let me thank you very much for your testimony.

I have a few questions, and I am sure maybe other Members of the committee will have some questions. We will try to limit our questions so everybody gets a chance, five to eight minutes each. Not that we will exceed that.

What kind of cooperation do you have with the states? In other words, it appears to me, and I think Senator Evans intimated this in a number of his questions. You have this match program with the states, in which they put up about $50 million and you put up $140 million.

Now, how many States participate in that?

Mr. **Frederick**. Senator Bradley, just one technical correction. The States' cost-share in the program; the Federal-State Cooperative Program, is a 50-50 match.

We put up $50 million, they put up $50 million. The additional amount of money that you described——

Senator **Bradley**. How many States cooperate?

Mr. **Frederick**. All 50 States.

Senator **Bradley**. All 50.

Mr. **Frederick**. And some of the territories.

Senator **Bradley**. How would you describe the efforts made in different states, in terms of quality? Are they uniform?

Mr. **Frederick**. No, sir. They are not necessarily uniform in terms of the amount of money the States have to offer. We have some very large programs and some very small programs. And they vary, based on the amount of money that the States can offer and the expertise that exists in the states.

Senator **Bradley**. List the top five states and the bottom five States.

Mr. **Frederick**. I am going to turn to our Chief Hydrologist to deal with that issue.

Senator **Bradley**. Fine.

Mr. **Frederick**. He may want to equivocate on that one, too. We can give it in terms of amount of money offered fairly easily.

Senator **Bradley**. Well, but I would also like to know what states are doing it well, and what is not being done in other states.

Mr. **Frederick**. Yes, sir. We will try.

Mr. **Cohen**. The largest programs are in the States of California and Florida, followed in terms of size very quickly by Texas and New Jersey, and probably New York.

The smallest programs—and they have been for nearly 100 years, that is how long this cooperative program has gone on—in terms of activity and expenditures are with some of the New England States, such as Vermont, New Hampshire, and Maine.

Senator **Bradley**. Now, when you say activities, you mean——

Mr. **Cohen**. Funding.

Senator **Bradley**. Only money?

Mr. **Cohen**. Funding and therefore, level of effort. Yes.

Senator **Bradley**. If you were devising a model state program, what things would you add to the programs now?

Mr. **Cohen**. With the realities of the financial situation that we and every other Federal agency finds ourselves in, the program is very substantial.

It has evolved over a period of 100 years. It differs significantly from State to State in terms of emphasis and focus. From the perspective of the Congress, I would suspect that if you or your staff looked at it deeply, you would be dismayed that some States apparently are getting a better deal than others.

That has been an evolutionary process, and I think to a large extent representing differences among States. As mandated by law, we can carry on no work unless the States offer their cooperative funding.

So I would say, the program is a healthy one, in the sense that it reflects the perspectives and the needs of the States, who are full and equal partners. From my point of view as a Federal official deeply involved in that program, I would say it is a reasonably well-balanced program, reflecting the State and local needs and reasonable responsiveness on the part of the Federal Government.

Senator **Bradley**. One of the things that strikes me in your presentation is that you are in control of a lot of information. But the other thing that strikes me is that there are some real gaps in information about groundwater resources.

Now, do you need any legislation to get the needed information for a database on groundwater resources?

Mr. **Frederick**. Senator Bradley, let me say a few things about that.

Specifically, in answer to your question, "Do we need legislation to deal with those gaps?", and I am speaking from a Geological Survey point of view at the moment, I guess I would say we do not think that new legislation would be a must.

We think it is within the charter of the Geological Survey to do the kinds of things we do to cooperate with the States, to do the investigations, to do the interpretation, and to set up the databases to collect that kind of information.

If one gets to the point that was pursued a little earlier by Senator Evans, in terms of whether one ought to prescribe data standards and codes and that sort of thing, one might need additional legislation.

I will defer to EPA because I believe they are probably in a better position to answer that specific question.

Senator **Bradley**. Let me ask you, what about your relationship with EPA? How is it formalized?

Mr. **Frederick**. We have an ongoing relationship with EPA at several different levels.

At the level here in Washington where we have a formal Geological Survey-EPA coordinating committee, that has various subcommittees to address most all of the issues that we have talked about here this morning. That committee meets about once every four months, and we begin to address some of the fairly critical issues and concerns.

We also have a relationship between our Regional Hydrologists and our District Hydrologists, who work in the States with EPA regions. There are some formal cooperative programs. There are agreements that are underway that work very well, we think.

We have some work to do in dealing with EPA, though, I would say, and we are working on that. EPA has some specific regulatory responsibilities where they must act now.

Senator **Murkowski**. I wonder if you would yield for just a short observation on EPA, without it being charged as a question, Mr. Chairman.

I am wondering if your agency is at times put in perhaps a combative relationship with EPA. Does EPA ever say, hey, you people have done an inadequate job?

Mr. **Frederick**. Senator Murkowski, EPA does say that "you take too long to get an answer that we need because we have got a problem that we have to solve right away."

Senator **Murkowski**. That is all. They do not say that "your job is inadequate."

Mr. **Frederick**. Well, that is one way of saying that the job is inadequate.

Senator **Murkowski**. They do not have any expertise in your area. How do they know that your work is inadequate?

Mr. **Frederick**. Senator Murkowski, they do have expertise in the area that we are talking about.

Senator **Murkowski**. As much as you do?

Mr. **Frederick**. Well, we would not say that. They might suggest that.

Senator **Murkowski**. Well, if they have as much expertise as you do, then they do not need you.

Mr. **Frederick**. We think they need us, and we think we can help them. We are working hard at this relationship with EPA, as I was saying.

And related to Senator Murkowski's question, some of the areas of concern have to do with the issue of: How can one assess the Nation's ground water? Can you do that? Should you do it this way? Should you do it the other way? Can you give us something that we can use tomorrow afternoon, or next year rather than 3 or 4 years in the future? These are all legitimate questions on the part of EPA, and we are trying to deal with them.

Senator **Bradley**. It seems to me that, as you were talking, it is clear that things that we do, lead, pesticides, fertilizer, whatever, eventually work their way into the water system, into groundwater. That we have over time monitored things like nitrates.

But there is a whole universe of organic chemicals, heavy metals, et cetera, that we have not monitored. Now, the only question is, over what period of time must they be monitored before you have developed enough of a database? And how soon? And what is the cost of monitoring in sufficient numbers?

Mr. **Frederick**. Let me ask Phil to deal with that. It is fairly complex question, Senator Bradley. I am not sure we can answer it all. But Phil will begin to address that.

Mr. **Cohen**. I think for the issue of point sources of contamination, especially those in which there are Federal statutes almost entirely being implemented by EPA, I think the Nation has made significant progress.

We, EPA and others have begun to do the work, have begun to do it on an experimental basis in some cases, on an operational basis in other cases. And we are beginning to get a sense of how frequently the data need to be collected and how the data need to be collected. That is for the issue of point source.

For the issue of non-point source, again, EPA, USGS, the Department of Agriculture, and a number of State agencies are beginning to make significant progress in trying to define and understand the nature and extent of non-point source contamination.

Now with that preamble, to answer your question is exceedingly difficult, because one has to frame the answer in terms of narrowing the scope of the issues.

If one were to talk about all the ground-water contamination issues, it would take a treatise simply to enumerate what the options are and it would be extremely difficult to begin to even move toward a concept of benefit-cost analysis, which gets people very nervous when we talk about health-related issues.

But the scale of this problem is such that if one wanted to fully address every problem we are aware of or we suspect, the funding implications would be enormous.

And from my point of view, the state of the science is such that it could not effectively absorb the maximum amount of funding we could conceive of to address all of these problems.

Senator **Bradley**. You are saying that even if we knew what to do with regard to groundwater, it would still be too expensive to do it.

Which means that if you have an aquifer that is polluted, cleaning that up, specifically cleaning that up might be too expensive.

Mr. **Cohen**. In some cases that——

Senator **Bradley**. So, are you saying that the analogue to groundwater contamination is or is not the Clean Water Act?

**Mr. Cohen.** That is something that I really have not given too much thought to, Mr. Chairman. I am aware of the fact that others are, especially those concerned with formulating legislation.

I would prefer to think about that and respond in writing, if I may.

[The information follows:]

Q: Do we need a piece of legislation like the Clean Water Act to protect the Nation's ground water?

A: The Clean Water Act and its various amendments is probably one of the most complex legislative and regulatory programs ever adopted. The 1972 Act replaced earlier stream water-quality standards with nationally uniform technology-based effluent standards with the goal of making the Nation's waters "fishable and swimmable" by 1983 and eliminating all pollution discharges by 1985. Many billions of dollars have been spent by Federal, State, and local governments and by industry since 1972 to control discharges.

It is not clear, given the multitude of sources of pollution affecting ground-water quality, that the approach used in the Clean Water Act would work if applied to ground water. Ground-water conditions and issues vary markedly from State to State. A recent study of ground-water protection programs by the National Research Council concluded that there is no single strategy that can be recommended for use by all States. The study did conclude, however, that it is important for ground-water management programs to view ground water as a resource to be protected.

What is clear is that there is only a limited understanding of ground water to support the implementation of some aspects of ground-water protection and clean-up programs. The principles of ground-water hydraulics are well understood and, theoretically, the response of an aquifer to different patterns of pumping can be accurately predicted. The occurrence in aquifers of dissolved solids (salt) and nitrates, two common contaminants, is fairly well known for many aquifers. On the other hand, information on pesticides and organic compounds is scarce because of the high cost of the analyses and the relatively recent development of analytical technology that can detect very low concentrations.

Our research has shown, for example, that the concentration of certain synthetic organic substances in ground water is highly correlated with land use. This suggests that consideration of land use will be one of a number of important factors in implementing ground-water protection programs. Traditionally, such land use decisions are made by local governments.

Widely different degrees of knowledge exist to implement most of the protection plans that presently have been suggested. Some plans will require more time and money to acquire supporting information than others. Each has social, economic, and technical implications that each State will have to weigh in developing the legal authority and funding to carry out its program.

The U.S. Geological Survey can assist the States with hydrologic advice, information, and training. A viable mechanism for carrying out such activities is the Federal-State Cooperative Program which consistently has received strong support from State and local agencies. In fiscal year 1987, more than 950 State and local agencies are contributing about $50 million which, in turn, is matched by the USGS and which is used to support USGS programs in support of State and local water management activities.

Senator **Bradley**. Senator Evans?

Senator **Evans**. Thank you, Mr. Chairman. Most of my questions were answered during the course of the presentation.

But, if you were to design a national program, knowing what we know now about the current problems and potential problems in terms of both supply and quality of groundwater.

As we look ahead to the continued growth of our economy and population and agriculture, either growth or whatever directions they take, what are the biggest gaps we have now, and what do you think needs to be done to have an adequate database so that we can have appropriate policies developed?

We can not do very much in terms of policies unless we have a database on which to base them. Where are our weaknesses and what ought we to be doing?

Mr. **Frederick**. Let me respond in general terms in that regard.

I guess I would say that I would begin to build on some of the programs that we have described here, in terms of some basic research, better understanding of the movement and fate of contaminants in the ground-water system, completion of some of the programs, like our regional aquifer systems analysis program that describes the resource itself, in terms of its quantity, extent, depth and movement.

I would build some of the relationships that we have begun to talk about with the States, with EPA, and the Geological Survey, to make sure that while we are paying attention to problems that may arise under an EPA-regulated program, that we keep in mind that this information and data might also be very helpful for some other programs.

So I think I would look at building on the existing programs, and begin some inter-links between some of the activities. And I think you will hear a bit more from EPA on some of those related issues.

Senator **Evans**. In the cooperative program with the States, the way it works currently, do you establish certain standards or certain requirements for the kind of information that States provide you in order to qualify for those dollars?

Mr. **Frederick**. The answer to that is, yes. Let me say just a little bit about the Federal-State Cooperative Program, because it is a little bit unique, compared to some of the other programs.

For the most part it is the Geological Survey that does the work and the research, the interpretive studies and the data collection. We put up half the funds. The State contributes the rest of the funds to the U.S. Geological Survey.

Those programs are accomplished using Geological Survey standards for data collection and analysis interpretation.

Senator **Evans**. And generally, are they connected with USGS personnel?

Mr. **Frederick**. For the most part, yes.

Senator **Evans**. So in this cooperative program it is really the State supplying half the money for a Federal agency to do what apparently would be a pretty consistent job nationwide, and then the Federal agency shares the information back to the States.

Mr. **Frederick**. Yes, sir. That is a reasonable description. We do set national priorities. But we also negotiate with the States and local governments to make sure that whatever is being done meets their requirements as well.

Senator **Evans**. What is the coordination between EPA and USGS in testing for contamination of sole-source aquifers?

We have some communities in our State, some fairly large communities, Spokane particularly, which depends on a sole-source aquifer for its drinking water.

For those communities who depend for their domestic water supply on sole-source aquifers, do you have any kind of a cooperative program or coordination between yourself and the EPA in doing testing and providing a database on what is going on?

Mr. **Frederick**. We have agreements with EPA on the general basis for how one tests and how the data can be interpreted when one tests.

However, I do not know of any specific arrangements for sole-source aquifer testing that we have with EPA. Let me turn to Phil and see if he is aware of any.

Mr. **Cohen**. When the sole-source aquifer program was first initiated, the Geological Survey played a major role in cooperating with State and local agencies that in turn were involved in the manner that Mr. Frederick described to you, in defining and working with sole source aquifers.

At the present time, our role has diminished somewhat. And it is largely being driven by the interests of the States for us to participate with them in sole-source aquifers that are of particular interest to them, and being driven by their willingness to contribute 50 percent.

With regard to specific activities ongoing in sole-source aquifers, I would have to refer to our records and provide the rest of the information for the record, Senator Evans.

[The information follows:]

## USGS ACTIVITIES IN SUPPORT OF THE EPA SOLE-SOURCE AQUIFER STUDIES

Under the general terms of the EPA-DOI Memorandum of Understanding dated July 24, 1973, the USGS and EPA signed an interagency agreement in January 1977 stating that the USGS would assist EPA's Office of Drinking Water in the gathering of hydrologic data required to designate sole-source (or principal source) aquifers under section 1424(e) of the Safe Drinking Water Act. This 1977 Interagency Agreement is renewed annually to reflect EPA's current needs.

The hydrologic data which are normally required in sole-source actions include: (1) description of the aquifer--location and boundaries, recharge zones, recharge rates, interaction of surface and ground water, vulnerability to contamination, characteristics of the aquifer and ground-water quality (total dissolved solids), and (2) background data on drinking water sources for an area--population, cities and towns presently using the petitioned aquifer as their sole source of water supply, possible alternative sources of water supply, and present and projected water consumption from the petitioned aquifer.

The USGS has completed hydrologic evaluations of:

- Statewide aquifers in California
- Biscayne Aquifer in southeast Florida
- Cape Cod aquifer in Massachusetts
- Aquifers in central Maryland (Piedmont Upland aquifer)
- Ozarks Aquifer in southern Missouri and northern Arkansas
- Potomac-Raritan-Magothy Aquifer in southern New Jersey
- Spokane-Rathdrum Prairie Aquifer in eastern Washington
- Delaware Basin Aquifers in southeastern New Mexico and western Texas
- Aquifers in southeastern Louisiana and southwestern Mississippi
- Snake River Basalt aquifer in eastern Idaho
- Bisbee-Naco alluvial basin aquifer in southeastern Arizona

The Bisbee-Naco study was completed in FY 1986, and no additional studies are underway or anticipated.

Senator Evans. One final question. I mentioned earlier the importance of conservation in the use of water, especially irrigation water, in order to avoid continued drawdown of many of our important groundwater aquifers.

One of the difficulties, it seems to me, is the current Western water law, particularly, which in essence requires that you use it or lose it. If a farmer, or if anyone has a water right, the last thing in the world they want to do is lose that water right.

They cannot afford to lose it. So there is no real incentive for using less water. In the electrical field, to advance electrical conservation, we have embarked on a program which essentially says, every business, every residence, every manufacturing plant is a miniature electrical producing plant.

And if they can use less electricity and do their job, we ought to pay for what we get. Especially if it is cheaper than building a new power plant.

Where should we start? What agency or what group of agencies would be the best to start investigating and helping us in the potential program that could lead to a change so that conservation would be encouraged and so that there would be an incentive for those who are engaged in agriculture, particularly, to use less water and get some benefit out of using less water, rather than just the chance of losing their water rights.

Maybe it is a cash payment. Maybe it is some other kind of benefit.

Mr. Frederick. I would suggest, Senator Evans, as you probably know, you will not find a single source that can give you a complete answer to that question.

Senator Evans. I know that.

Mr. Frederick. Yes, sir. I would suggest that you start in the Department of the Interior with the Assistant Secretary for Water and Science, who happens to be our boss.

He is also the boss for the Bureau of Reclamation. I am not steeped in that particular subject, but I have been involved enough to know that there is serious concern and interest on the part of the Bureau of Reclamation and Assistant Secretary Jim Zigler on the subject of conservation.

They have thought long and hard about the issue in terms of what contribution Interior and the Bureau of Reclamation might make. So I suggest you talk to the Assistant Secretary.

Senator Evans. Thank you very much.

Senator Bradley. Thank you very much for your testimony.

Our next panel is Mr. Lawrence Jensen, Assistant Administrator for Water, Environmental Protection Agency, and he is accompanied by Ms. Marian Mlay, Director, Office of Ground-Water Protection.

Let me welcome both of you to the committee. You have heard a number of references to EPA. So we are looking forward to your testimony.

## STATEMENT OF LAWRENCE J. JENSEN, ASSISTANT ADMINISTRATOR FOR WATER, ENVIRONMENTAL PROTECTION AGENCY; ACCOMPANIED BY MARIAN MLAY, DIRECTOR, OFFICE OF GROUNDWATER PROTECTION

Mr. Jensen. Thank you, Mr. Chairman. I am not used to being deferred to so readily.

Let me, if I may, summarize some of the major points that we made in the written testimony that we have submitted to the committee.

I would like to say at the outset that I welcome the interest of this committee in the issue of groundwater protection. Certainly it's one of the important environmental issues currently, and I think will be for some time to come.

In my written statement I addressed three points. One, some comments about the nature of the resource and some of the threats that we are facing. Rather than review that, let me say, Mr. Chairman, that I very much appreciated your opening remarks where you emphasized the importance of the resource and your concern at some of the distress signals we see, with reference to the impact of man's activities on the resource.

I appreciated your recognition that we are not at this point in a crisis stage. In some ways, we are at a very favorable point to deliberately address the question of how we can best manage our groundwater resources in the country over the long term.

Let me make comments in two other areas, and then I would be happy to take your questions. Just a brief overview of the current statutory authority that the Agency has, and then some comments about the Agency's Groundwater Protection Strategy, which is really our attempt to take the several authorities which Congress has given us and, where necessary, bring some coherence to our administration of those authorities.

We have substantial authority in the area of groundwater protection. Perhaps much more than people generally realize.

The principal statutes, certainly in terms of the current financial commitment that goes with them, are ones that you are well familiar with, RCRA and Superfund, which lay out rather comprehensively how we manage and clean up hazardous waste in this country.

But there are other statutes as well. Under FIFRA we control the availability and use of pesticides, many of which have a potential to leach into the groundwater.

Under the Safe Drinking Water Act, we are involved in setting drinking water standards, which increasingly are used as reference points in making decisions about groundwater protection and groundwater cleanup.

Under that same statute, we regulate the injection of wastes into wells in the ground for purposes of disposal. We also, as a result of the amendments made to the Drinking Water Act just a year ago, are now responsible for administering what is called the Wellhead Protection Program.

This requires states to identify their wellheads, to delineate areas around them through which contamination might move and get into those water supplies, and then to address in a comprehensive fashion on a state by state basis how they might protect those particular water supplies, the ones feeding their wellheads from the man-made contamination.

Under the Clean Water Act, we have also given, I believe, substantial assistance to states through grant support to assist them in the development of comprehensive state groundwater strategies.

I have been very encouraged over the past couple of years with the response of states to that aid. Currently more than half of the states either have developed comprehensive groundwater protection strategies, or are in the process of doing so, and have been assisted in that effort by the grant monies that we have given them.

We have our own research program at the Agency, that we have carefully reviewed to ensure that it focuses on the questions of most importance to the Agency, with respect to groundwater protection.

In short, we provide through a number of statutes and programs a wide range of standard-setting, technical assistance, compliance, enforcement, research, monitoring, and other activities that are geared toward protecting groundwater.

We recently did a study in the Office of Water about how these various statutory authorities are being implemented in the Agency. We did that in response, to a list that was developed here 2 or 3 years ago by the Office of Technology Assessment.

They identified 33 principal sources of ground-water contamination in the country. And the question I asked was, to what extent are we addressing those sources? And I think the results are rather revealing, and we would be happy to share that report with the committee.

Of the 33 sources which were listed by OTA, under our current authorities, we are addressing in some fashion 25 of those 33 sources of groundwater contamination.

The only sources which we are not addressing in some fashion, either through a regulatory program or at a minimum technical assistance and guidance to the states, are things like cemeteries, animal feed lots, material stockpiles.

So I think it is well to bear in mind as you begin your review of the groundwater policy in the country, that there is already substantial Federal authority, certainly at EPA, to address primarily on a source-by-source basis a wide variety of identified sources of groundwater contamination.

Senator **Bradley**. Would you provide to the committee the EPA response to the OTA study?

Mr. **Jensen**. We would be happy to do that. Yes.

Senator **Bradley**. And in specifics?

Mr. **Jensen**. Yes. Let me make some general comments on one other area, and then I would be happy to take questions.

Partly as a result of the facts which you cited in your opening statement, partly as a result of the variety of statutory authorities that Congress has given us, we felt a need at the Agency to review those authorities and develop what we have termed a groundwater strategy.

To do our best to make a coherent and consistent application of the authorities that Congress has given us, and to articulate what we felt was the appropriate Federal role in the protection of groundwater.

We developed that strategy and published it in 1984 for the first time. And it has played a significant role in guiding our regulatory decisions since that time. Let me just review the major principles that are highlighted in that strategy and perhaps providing that document to you as well might be of assistance to you.

First and fundamentally, we recognize that the primary role in the protection of groundwater should lie with the states.

And I think in making that recognition there are many who join us in recognizing that both historically and legally groundwater management and groundwater protection has traditionally been a responsibility of the states, related to their primary roles under our Federal system in controlling land use and in allocating the use of water generally.

As a result of this recognition, one of the key components of our groundwater strategy at the Agency has been to do all that we can to strengthen the states' capacity to develop groundwater protection strategies.

I indicated earlier that as a result of grant monies that we have made available to the states, we have seen a significant amount of activity on the part of individual states in assessing their own peculiar groundwater problems and developing strategies appropriate to deal with them.

We also recognized in the groundwater strategy that Congress has charged us with the primary role in the control of particular sources of contamination to groundwater, and we have been diligent in carrying out those authorities.

I mentioned them in my introduction. Principally, the management of hazardous wastes, and also the authority that we have under the Safe Drinking Water Act.

We also felt a need as we reviewed the groundwater situation for a greater consistency in the way the Agency as a whole made decisions about how to protect groundwater or how to clean it up.

We found that one program under one statute was making a decision about how to protect groundwater in one way, and the other perhaps in another, responding to different mandates from Congress. In some cases, even a little different formulation of standards which were to be followed.

And we felt that we could do a great deal to bring a greater consistency to our overall effort if we could develop at the center of our efforts at the Agency a consistent policy statement.

And we have done that. Primarily what it involves is the development of what we call classification guidelines, which are then to be used as appropriate throughout the Agency in the administration of all of our regulatory authorities.

Those classification guidelines recognize something that we think is fundamental to an appropriate groundwater management program, and that is that all groundwater is not created equal.

The hydrogeology varies significantly from state to state, from place to place, and the uses to which the groundwater can be put in its natural state vary. And we felt like those differences ought to be taken into account in a consistent way as we make the decisions across the agency.

So we have developed a 3-tiered set of classification guidelines. We have recently had those guidelines out for public comment. I believe the comment period is closed now, and we are at the point of assessing the comments made by the public before we publish those guidelines.

Once published, of course, there is a second phase to the use of that type of a tool, and that is it will have to be applied in the individual programs. It will have to be applied and worked into the fabric of the Superfund program, the RCRA program, of our pesticides program, and our drinking water programs.

Enough said. What I wanted to do is give you some sense of the substantial authority that we have, of the encouraging signs that we have seen in recent years with the states taking initiative and developing comprehensive programs.

Having given you that background, we would be happy to respond to your questions.

[The prepared statement of Mr. Jensen follows:]

STATEMENT OF
LAWRENCE J. JENSEN
ASSISTANT ADMINISTRATOR FOR WATER
U.S. ENVIRONMENTAL PROTECTION AGENCY
BEFORE THE
SUBCOMMITTEE ON WATER AND POWER
COMMITTEE ON ENERGY AND NATURAL RESOURCES
UNITED STATES SENATE

June 5, 1987

Good morning, Mr. Chairman and members of the Subcommittee. I am Lawrence J. Jensen, Assistant Administrator for Water of the U.S. Environmental Protection Agency. With me today is Ms. Marian Mlay, Director of the Office of Ground-Water Protection.

We are pleased to be here today to talk about EPA's efforts to protect ground-water quality, and we appreciate this Subcommittee's interest in the nation's ability to address the complex and difficult problems of ground-water protection.

As you are aware, there is now a growing awareness among public managers, scientists, environmentalists, politicians, and industry that ground-water contamination is one of the important environmental issues of the 1980s and probably for decades to come. All across the country, the public's interest in and recognition of the importance of this resource is increasing rapidly. Yet, protection of the resource from contamination has greatly challenged the institutional and technical capabilities of government at all levels.

Ground-water protection is one of EPA's top priorities. Many of our major programs and a large percentage of our budget directly support the protection of ground-water quality. I would like to briefly describe for you today three areas related to our ground water protection program--first, the extent of our knowledge on the resource itself; second, the existing authorities for protecting ground water under EPA's statutes; and finally, the principles which guide our efforts to coordinate and implement those authorities.

## Nature of Ground Water

The importance of ground water is increasingly recognized, not only as a source of drinking water, but also for agricultural and industrial activities. About one-fourth of all the fresh water used in this country comes from the ground.

Ground water currently supplies 50% of the population's drinking water--117 million people. It provides 35% of the drinking water supply used in urban areas, and 95% of the supply in rural areas. The agricultural states in the Midwest and the West depend heavily on ground water for irrigation. One-third of the water used for irrigation in this country is drawn from the ground. For the eastern industrial states, 30% of the ground-water withdrawals are used for industrial activities.

Although we are constantly expanding our understanding of the nature of ground water and the extent of contamination, we may never have a complete picture. Our current data are fairly limited, and monitoring is very expensive and technically difficult. The best indicator we have of the extent of contamination comes from drinking water drawn from wells--20% of all drinking water systems using ground water and 30% of the larger ground-water systems show at least trace levels of volatile organic chemicals (VOCs). However, we estimate that only about 2.5% of all public drinking water systems relying on ground water exceed standards for VOCs that we are about to issue.

Over the years, our experience at EPA has shown that once ground water is contaminated, cleaning it up is difficult, expensive, and sometimes unsuccessful. For many reasons, the prevention and clean up of ground-water contamination is substantially more complex than for air and surface water contamination.

For example, the rates of movement and mixing of ground water are dramatically different from those for air and surface water. Ground water flow is measured in feet per year while river flow is measured in feet per second. It is not as easily accessible for monitoring as air and surface waters are. Taking a sample of ground water often involves drilling wells or using remote geophysical methods, and the information obtained may sometimes be meaningless a short distance away from the sampling point. Experts commonly disagree on the levels of contamination in ground water at many small sites. In addition, there is a shortage in many areas of the U.S. of highly skilled people to collect and analyze the available data.

Another important reason why protecting this vital resource is one of our most complex environmental issues is that it involves potentially millions of individual sources of contamination and an enormous array of domestic, commercial and industrial practices. Protecting ground water involves addressing about 1500 hazardous waste land disposal facilities, a large number of Superfund sites, thousands of surface impoundments, over a million underground tanks, and millions of residential septic systems, and the use of millions of pounds of pesticides and millions of tons of fertilizers. The potentially regulated community encompasses not only a few large industries and businesses, but also small businesses, individual homeowners and farmers.

Having given you some background on the extent of our knowledge about ground-water contamination, I think it is important to put the "ground-water problem" in some context. EPA recently undertook a comparative evaluation of 31 environmental problems from the standpoint of the risks they pose to human health and the environment. Surprisingly to some, the risks posed by contamination from sources such as leaking storage tanks, and active and inactive hazardous waste sites ranked relatively low in terms of the risks compared to those from other environmental problems.

However, it is important to know that in doing our evaluation we gave greater weight to problems affecting large numbers of people, that we were limited by the lack of available data on the extent and significance of ground water contamination, and that the potential accumulation of contaminants in ground water over time was not factored in.

## Statutory Authorities

Through various environmental statutes, EPA has responsibility to establish and enforce standards and regulations to protect and clean up ground water from a variety of sources of contamination. The Resource Conservation and Recovery Act of 1976 (RCRA) provides authority to prevent hazardous wastes from leaching into ground water from hazardous waste facilities, and from sources such as municipal landfills, impoundments and underground tanks. As you know Mr. Chairman, the Comprehensive Environmental Response, Compensation and Liability Act (Superfund) provides EPA with major authorities and resources to clean up hazardous waste sites which present an extensive threat to human health or the environment.

Through the Federal Insecticide, Fungicide and Rodenticide Act (FIFRA), we control the availability and use of pesticides which may leach into ground water. Under the Safe Drinking Water Act (SDWA), we set drinking water standards which are used as the basis for ground-water protection actions and we control the injection of fluids into the ground.

We also provide assistance to states in the development of ground-water protection strategies through the Clean Water Act, and we are initiating a program under the Safe Drinking Water Act

Amendments of 1986 to assist states in protecting the ground water entering the wellhead areas of all public water wells.

I would also like to point out Mr. Chairman, that over the years in implementing our ground-water programs, EPA has developed a substantial ground-water research program to support our legislative mandates. Currently, our ground-water research program includes a wide variety of research, development, and monitoring efforts which are required to support our regulatory development, compliance, enforcement and ground-water clean up responsibilities.

We are currently pursuing five goals under this program: (1) to develop procedures for monitoring and evaluating ground water quality; (2) to improve the ability to predict the fate and transport of contaminants in ground water; (3) to develop practices, methods, techniques, or processes effective in controlling sources of contamination; (4) to develop methods and techniques to restore ground water that has been damaged; and (5) to provide technical assistance and technology transfer on all of these subjects.

In short, we provide through our various statutes and programs a wide range of standard setting, technical assistance, compliance, enforcement, research, monitoring and other activities geared toward protecting ground water. We recently released a report summarizing all of the Agency's activities to address 33 sources of contamination that were identified by the Office of Technology Assessment (OTA) in 1984. This report contains a listing of 270 EPA programs and activities, and points out that we are addressing 25 of OTA's list of 33 sources, including almost all of the major sources. Not surprisingly, the Agency has a higher level of activity focused on sources that are directly regulated under EPA's statutory mandates than those that are not.

## EPA's Ground-Water Protection Strategy

In the late 1970s, we recognized that EPA's role in this area was fragmented, largely undefined, and clearly controversial. The Agency drafted and later issued a Ground-Water Protection Strategy to articulate what was known about the problem and what the appropriate EPA response should be. While the Strategy was issued in 1984, it has a lot of relevence to the issues we are facing at EPA today in 1987. In fact, you will find that it is similar to many of the recommendations put forth by the National Ground-water Policy Forum this past January.

First, the Strategy lays out both the states' and EPA's roles in the protection of the resource. It recognizes that states should have the principal role in protecting ground water. This is mainly due to their historical and legal roles in land use and water allocation, as well as the localized nature of most activities causing ground-water contamination.

As I mentioned earlier, the sources of contamination number in millions across this country, and dealing with many of those sources involves local land use decisions. The Strategy recognizes that the federal government should not be involved in those types of decisions. Under existing authorities EPA, however, has a role in controlling the use of certain toxic contaminants of national concern, setting minimum standards for major sources of contamination, research and development of protection and clean up technologies, and in providing leadership for ground water quality protection.

Second, the Strategy identifies four objectives for EPA's role in ground-water protection: (1) to strengthen the states' capacity to protect the resource; (2) to give greater emphasis to sources of contamination that are of particular national concern; (3) to establish a consistent ground-water protection policy for EPA regulatory programs; and (4) to coordinate ground-water protection activities internally as well as with other federal agencies and the states.

We have made substantial progress in implementing our Ground-Water Protection Strategy. In order to strengthen the states' capacity to protect the resource, the Agency has provided financial assistance to states both for developing ground-water protection strategies with a grant program under the Clean Water Act, and now beginning in FY 88 we will be providing grants to states for the development of wellhead protection programs under the SDWA.

At this time, over half the states have developed strategies, and the rest are in the process of doing so. In addition, EPA has been providing technical assistance to states. For example, last year we issued a technical assistance document on controlling contamination from septic tanks for state and local officials.

We are also sponsoring a strong technical assistance and training program through workshops and conferences. Further, we maintain a ground-water modeling center and clearinghouse.

In response to increased statutory authority and the second objective of the Strategy--to give greater emphasis to sources of contamination of particular national concern--the Agency is developing a major control program to regulate underground storage tanks, is implementing the land disposal restrictions and technical requirements for land disposal facilities called for under the Hazardous and Solid Waste Amendments of 1984 (HSWA), and is developing regulations for municipal landfills. We have also greatly increased our efforts to address the growing problem of pesticides in ground water. We are conducting a national survey of pesticides in water wells, and developing an Agricultural Chemicals in Ground Water Strategy. In addition, the Agency has incorporated new requirements under FIFRA registration of pesticides to prevent adverse impacts from the use of chemicals that have a potential to leach into the ground water.

## Creating A Consistent EPA Program Policy

One of the major concerns addressed in the Strategy is the need to achieve greater consistency in decision-making among the many EPA programs related to the protection of ground-water resources. In the past, the Agency has focused primarily on protecting ground water from individual polluting activities. This emphasis failed to provide consistent levels of protection from each program. States and industry were faced with EPA programs that overprotected in some instances and under-protected in others.

It became clear that the Agency should direct its program activities toward a consistent set of protection goals. While the broad goal of EPA's ground-water protection efforts is to protect human health and the environment, the Agency needed a policy or operational tool that would guide ground-water decisions to reflect clear priorities and directions. In the Ground-Water Protection Strategy, EPA adopted a policy which will minimize risks to human health and the environment while realistically protecting the resource.

This policy provides base level protection for most ground water. For these ground waters, EPA would then apply our current protection approaches, gearing our efforts so that the highest beneficial use, drinking water, would be protected. The Strategy recognizes, however, that some ground waters deserve greater protection than others due to their particular uses, relative value to society, and hydrogeologic vulnerability. For these, protection will be the most stringent. Other ground waters with little value for water supply will not require the same degree of protection. In short, EPA will use a classification system to determine the degree of protection which will be afforded ground water resources. This is a way of focusing EPA's and society's resources on the most important areas.

This approach has been recognized and adopted on a voluntary basis by many states as a logical and protective way of managing ground water and was widely supported by major national groups when the Strategy was made available for comment. The same sort of approach is currently used in our air and surface water programs.

This approach is now being developed into a three-tiered ground-water classification system for use by EPA programs. Class I is reserved for "special" ground waters. These are ground waters which are highly vulnerable to contamination due to their hydrogeologic characteristics and are critically valuable to society in that they are either irreplaceable sources currently used as drinking water for substantial numbers of people or they supply base flow to ecologically-vital areas which, if polluted, would destroy unique habitats. Because these ground waters are of unusually high value to society, they may, therefore, require tighter controls over sources of contamination. Class I represents a small number of total ground waters where consequences have been and would be the most serious.

Class II covers the majority of ground-water settings. This class includes both current and potential sources of drinking water and is broad enough to encompass other beneficial uses such as irrigation and most baseflow to wetlands and streams. The bulk of EPA's existing regulatory strategies are already designed for these Class II settings and constitute "base level" protection.

The remaining class, Class III, is another small category. These ground waters are not currently used as drinking water supplies and have few, if any, other beneficial uses. These waters may, in their natural state, be of poor quality or have undergone broad-scale degradation from human activity. Management approaches for these ground waters would reflect the fact that cleaning up to drinking water quality is infeasible and the contamination will not affect human health or the environment.

EPA expects to use the classification process primarily as a tool in prevention decisions in site-by-site decision-making. For example, EPA would not classify broad segments of aquifers in advance of a given decision. Such anticipatory classification is clearly understood as the role of state government.

The Office of Ground-Water Protection is already working with EPA program offices in defining appropriate protection and clean up strategies for different classes of ground water. The Office is helping to modify Agency programs to incorporate the classification system in their guidelines and regulations. It should be noted that EPA will recognize the use of state classification systems.

## Conclusion

Finally, Mr. Chairman, I would like to make one last point about national ground-water policy. If we have learned nothing else at EPA about hazardous wastes and contaminated ground water, it is that it is very difficult and very expensive to clean up environmental problems.

For example, millions of pounds of pesticides are dispersed over vast acres of farmland. When managed and used properly, pesticides are a great benefit to society. However, should residues from some of these pesticides reach valuable ground waters at unacceptable levels, it will be virtually impossible to clean up if the contamination is widespread. This is clearly one case where we must emphasize prevention over clean up.

Approximately 12 million private drinking water wells are used in this country. A majority of the water drawn from those wells is not treated for contaminants. Further, it is not likely that cheap or easily maintained treatment will be available for those people in the near future. This is another example of where we should emphasize prevention over clean up.

In addition, we are being pushed to spend hundreds of millions of dollars at Superfund sites to clean up very small levels of chemical contaminants that, in some cases, pose low risks to human health. Clearly, it makes more sense to recognize that there is a level below which science tells us there is no significant health threat, and to try to direct more of our resources toward prevention. It is time for all of us--federal, state, and local governments, industry, and the public--to work together in protecting this valuable resource.

Mr. Chairman, I hope that I have given you an idea of how important EPA considers the issue of ground-water protection, and how much we are doing at the Agency, and with state agencies, to implement a national protection policy for ground water. This concludes my presentation. I would be happy to answer any questions you might have at this time.

# 1986 STATUS REPORT
# ON THE
# IMPLEMENTATION OF EPA'S GROUND-WATER PROTECTION STRATEGY

OFFICE OF GROUND-WATER PROTECTION
OFFICE OF WATER
U.S. ENVIRONMENTAL PROTECTION AGENCY

APRIL 1987

# 1986 STATUS REPORT
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## INTRODUCTION

The Office of Ground-Water Protection (OGWP) was established in April 1984 to coordinate EPA's efforts in protecting the nation's ground-water resources. In August 1984, EPA issued the Ground-Water Protection Strategy. The purpose of this report is to set forth the Office of Ground-Water Protection's progress in carrying out its mission of assisting EPA to implement this Strategy. It covers roughly calendar year 1986.

EPA's Strategy provides a general framework for the Agency's ground-water protection activities. It acknowledges the principal role of the States in ground-water protection and defines four key goals to guide its implementation:

- Strengthening the capacity of State government to protect ground-water quality;
- Addressing ground-water contamination sources of particular national concern;
- Establishing a consistent EPA programs policy which considers the use and value of ground water and its vulnerability to contamination in the administration of environmental programs; and
- Coordinating the development and implementation of ground-water protection policies with EPA Headquarters and the Regional Offices, other Federal agencies, and with the many constituencies interested in this issue.

During the Office's first year, EPA made progress in achieving the Strategy's goals by establishing and staffing ground-water protection offices in its Headquarters and Regional Offices, and setting up various coordinating committees to serve as vehicles for communication at Headquarters and the Regions. The Office also developed a Ground-Water Monitoring Strategy and drafted guidelines to implement the Agency's differential protection policy through a ground-water classification system. In addition, OGWP, through the Regions, assisted States in developing ground-water protection strategies under the Clean Water Act section 106 State Ground-Water Strategy Grants Program.

In FY 1986, Congressional enactment of the Safe Drinking Water Act Amendments (SDWAA) reinforced the Strategy's goals by providing EPA with further authority to assist States in promoting comprehensive protection of ground water as a vital resource. The Amendments recognize that the States have the primary role in ground-water protection and authorize two new State grant programs, the Wellhead Protection (WHP) Program and the Sole Source Aquifer (SSA) Demonstration Program. Both programs recognize the need for State flexibility to tailor their own programs to specific institutional conditions and hydrogeologic settings.

The WHP Program is designed to protect the wellhead areas of all public drinking water systems from contaminants which may have adverse effects on human health. It is intended to be a State developed and administered program with States determining the extent of the area around the well to be protected. The SSA Demonstration Program builds upon the Act's existing Sole Source Aquifer provisions. Its purpose is to demonstrate special protection measures for Critical Aquifer Protection Areas (CAPAs) within a designated Sole Source Aquifer.

In carrying out the Wellhead Protection and SSA Demonstration Programs, the State is responsible for evaluating the ground-water conditions in its jurisdiction and determining the appropriate actions for protecting this resource. OGWP and Regional Ground-Water Offices will provide guidance and leadership, as well as influence the direction of future ground-water protection activities based on the experience of the first two years of program activity.

## GOAL I: STRENGTHENING STATE PROGRAMS

EPA's Ground-Water Protection Strategy recognizes that States have the principal role in ground-water protection. Moreover, the most effective way to increase national capacity to protect ground water is to strengthen State institutions. To respond to the Strategy, the Office of Ground-Water Protection is committed to providing support and encouragement to the States for ground-water program development and institution building. In 1986, OGWP[1] made substantial progress in carrying out this mandate through the administration of ground-water grants to States under section 106 of the Clean Water Act and through initiating development of the new programs under the SDWAA. In addition, OGWP provided several studies and analyses, as well as technical assistance to the States. This included a review of selected State and local ground-water programs, publication of a report on State statutes relating to ground water, and sponsorship of a series of university symposia on State and local ground-water policy issues.

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[1] References to OGWP include, in general, both Headquarters and Regional programs as both play a key, though somewhat different role in program development and implementation.

## WELLHEAD PROTECTION PROGRAM

OGWP's implementation of the Wellhead Protection Program represents a major effort in strengthening the States' ability to deal with the ground-water contamination problem. Since the enactment of the 1986 Amendments, the Office of Ground-Water Protection has worked closely with the States to meet its statutory requirement to issue technical guidance on the criteria for delineating a wellhead protection area. OGWP also initiated the development of guidance for States on applying for grants to develop and implement a State wellhead protection program. To supplement this guidance, EPA also has been preparing several technical assistance documents to provide States an array of options and information on the institutional and technical aspects of designing a State program.

To ensure flexibility in the program, as well as sound technical and management approaches, OGWP solicited participation from nearly 200 individuals from Federal, State, and local agencies; environmental groups; business and industry; and universities at several stages in the process of developing technical guidance and program implementation policies and procedures. To facilitate this process, the Office established three technical committees, each addressing a different aspect of the WHP Program, hydrogeological criteria, State management plans, and grants management. Each committee held several meetings to help plan and review guidance documents. In addition, OGWP organized two workshops, one on the delineation of a wellhead protection area and the other on management protection methods. By June 1987, OGWP expects to issue its final guidance to the States on how to participate in the WHP Program. Since funds have been provided for this program in the President's FY88 budget, it is expected that States may begin to apply in the fall.

## SOLE SOURCE AQUIFER DEMONSTRATION PROGRAM

The Sole Source Aquifer Demonstration Program is also included in the SDWAA of 1986. Since 1974, EPA has had the authority to designate aquifers as the sole or principal drinking water source for an area and thereby provide for the review of all Federally-assisted projects that may contaminate an aquifer. The new SSA Demonstration Program is intended to encourage States and localities to demonstrate special protection measures for Critical Aquifer Protection Areas (CAPA) within a designated Sole Source Aquifer.

Because designation is a prerequisite for eligibility for a SSA demonstration grant, OGWP established a committee to streamline the existing procedures for designating Sole Source Aquifers. To assist States in meeting the statutory deadline of June 1988 to qualify for SSA Demonstration Program consideration, OGWP designed a process that could be completed within approximately 6 months. With the assistance of Regional ground-water coordinators, OGWP produced two guidance documents, EPA Petition Review Guidance and Petitioner Guidance, which were issued in March 1987. This streamlining included reducing the number of required Federal Register notices associated with the SSA designation process (using newspaper publicity instead) and transferring responsibility for the designation decisions from the EPA Administrator to the Regional Administrators.

In addition, OGWP began to develop the needed rule and guidance to implement the SSA Demonstration Program. The first is a rule, required by statute, which defines the criteria which are to be applied in the identification of a CAPA within a Sole Source Aquifer. Applicants for demonstration program grants will be expected to meet these criteria in order to be eligible for grants. The rule will be issued by June 1987 as required by the SDWAA. In addition, grant guidance was also initiated using the same committees and process as for the Wellhead Protection Program.

## STATE GROUND-WATER STRATEGY GRANT (SGWSG) PROGRAM

Prior to the 1986 SDWAA, OGWP's principal means of strengthening State ground-water protection programs has been through State Ground-Water Strategy Grants (SGWSG) under section 106 of the Clean Water Act. In FY85 and FY86, OGWP awarded nearly $14 million to the States and Territories for the development and implementation of ground-water protection programs. In allocating these funds, OGWP placed the highest priority on the development of ground-water protection strategies because they provide the framework for all subsequent ground-water protection activities.

Every State and all but one Territory has participated for at least one year in the State Ground-Water Strategy Grants Program, and all but four have participated for two years. The role these grants have played, however, in the development and implementation of State programs varies widely among the recipients. The States range from those which created a ground-water protection framework almost exclusively with SGWSG funds, to those which used the grants to expand and increase the scope of existing programs that predated the SGWSG Program, to those which undertook preliminary analyses. In general, most States and Territories credit their significant achievements in ground-water characterization and protection to the availability and use of SGWSG funds.

Generalizations concerning the use of State Ground-Water Strategy Grants by the States and Territories must be drawn carefully, since the range of ground-water protection activities the grants have funded is extensive. Nonetheless, the evidence supports at least the following general observations:

1) Consistent with EPA guidance, SGWSG funds have played a critical role in the development of State ground-water protection strategies.

2) Many States and Territories have perceived the need for better coordination among the various agencies involved in ground-water protection and have used SGWSG funds to address this need.

3) The SGWSG Program has contributed significantly to State and Territorial efforts to create an accommodative legislative and regulatory framework for their maturing ground-water protection programs.

4) Emphasis in the use of SGWSG funds has been given to technical activities designed to map and characterize ground-water resources, develop classification schemes, and implement quality standards.

5) Concurrent with the growing array of technical activities supported by SGWSG funds is the increasing need for more advanced data base management systems. SGWSG funds have played an important role in States' attempts to address this need.

Furthermore, the evidence implies that SGWSG funds provided an impetus to some State legislatures to assign greater priority to and provide more State monies for ground-water protection programs. The grants served as a catalyst for the expansion of interest in and understanding of ground-water problems and issues.

As a final observation, SGWSG funds appear to have been instrumental at times in overcoming significant obstacles to the development of State strategies and to the implementation of State programs. Beyond the obvious problems concerning scarcity of funds, SGWSG funds also helped overcome bureaucratic inertia, assisted in clarifying the roles of competing agencies through the establishment of coordinating committees, and helped educate the public and industry about the nature and scope of the problem. A report on this program has been published.

## SURVEY OF STATE GROUND-WATER PROTECTION LEGISLATION

As part of its efforts to strengthen States, OGWP supported the National Conference of State Legislatures in conducting a survey of 1985 State legislation addressing ground-water protection. The purpose of the survey was to assist States in formulating appropriate ground-water policies by providing information on how all States were approaching the ground-water problem in their policymaking. The report, Survey of 1986 State Ground-Water Quality Protection Legislation, compares legislation enacted by each State in 1985, summarizes all categories of legislation on a State-by-State basis, and summarizes legislation by category (e.g., standard setting, land use management, aquifer classification, ground-water funds, agricultural chemicals, underground storage tanks, and water use management). To provide further assistance to States in drafting new legislation, the report includes a list of relevant State legislative staff who can provide additional information.

## NRC STUDY ON STATE GROUND-WATER MANAGEMENT

In another project to assist States in developing and strengthening their ground-water protection programs, OGWP and the Office of Research and Development directed and supported a National Research Council (NRC) evaluation of ten State and local ground-water protection programs. The purpose of this evaluation was to identify specific practices and procedures which have been effective in protecting ground-water quality. The evaluation, funded by an Office of Research and Development grant to the National Academy of Sciences, was carried out by a committee of 13 experts in the fields of public policy and science. The final report, Ground-Water Quality Protection: State and Local Strategies, was published last July.

## UNIVERSITY SYMPOSIA

In providing assistance to States in institution building and program development, OGWP recognized the need to bring together representatives of State and local governments with members of the academic community to exchange ideas and experiences related to the establishment and implementation of ground-water protection programs. To respond to this need, OGWP awarded a grant to a consortium of three universities to conduct a series of symposia in FY 1985 and FY 1986 on policy issues related to ground-water protection.

In FY 1986, the consortium, consisting of the University of Oklahoma, Oklahoma State University, and Rice University, held three two-day symposia on various ground-water pollution control issues. In October 1985, the consortium conducted a symposium on institutional coordination for ground-water pollution control in Philadelphia. In January 1986, a symposium held in Atlanta focused on local government options for ground-water protection. In May, the consortium conducted a symposium in Cambridge which addressed liability issues. The symposia were attended by over 700 individuals, including policymakers from State, Regional, and local agencies; researchers; and representatives of the academic community, industry, and special interest groups. At each symposium, there were round-table discussions and presentations of papers on a variety of topics. The proceedings have been distributed to individuals in State and local governments around the country to provide insights on the variety of problems which have to be confronted in ground-water protection, and to suggest various policy approaches in dealing wih those problems. They are being published in the professional literature.

## GOAL II: ADDRESSING SOURCES OF CONTAMINATION

EPA's Ground-Water Protection Strategy pointed out that certain sources of contamination are of particular concern to ground water, and therefore require additional attention through its ground-water protection activities. It identified underground storage tanks as one, and subsequently provisions were included in the Hazardous and Solid Waste Amendments of 1985 to specifically address the issue. Since septic tanks are consistently identified as a key contamination problem, OGWP published a set of technical assistance documents on septic tanks. Pesticides were also targeted as a high agency priority. Thus, the Agency and OGWP have undertaken a number of activities to address contamination from agricultural chemicals. This includes producing two publications on the use of pesticides, and actively participating in EPA's efforts to develop an Agricultural Chemicals in Ground-Water Strategy.

### TECHNICAL ASSISTANCE DOCUMENTS ON SEPTIC SYSTEMS

In addressing septic systems as a major source of ground-water contamination, OGWP assembled a group of experts from State and local governments, industry, and environmental and other organizations to determine key management considerations for septic tank use and maintenance. The group met several times during FY 1986. Its recommendations are incorporated in a set of technical information documents published by OGWP, Septic Systems and Ground-Water Protection: A Program Manager's Guide and Reference Book and Septic Systems and Ground-Water Contamination: An Executive's Guide.

During FY 1986, OGWP distributed several thousand of these documents to concerned individuals, government agencies, corporations, and private organizations around the country and made them available through purchase from the Government Printing Office. It is hoped that through such widespread circulation of these materials, State and local officials will have available to them the best thinking of these technical, legal, and managerial experts on how to design and implement programs to prevent or reduce ground-water contamination from onsite waste disposal.

## EFFORTS TO ABATE PESTICIDE CONTAMINATION

The Ground-Water Protection Strategy cites the use of pesticides as a potentially significant source of ground-water contamination that requires additional national attention. Soon after the Strategy was issued in 1984, OGWP began collaborating with EPA's Office of Pesticides and Toxic Substances (OPTS) to determine how the Agency's authorities under the Federal Insecticide, Fungicide and Rodenticide Act, the Toxic Substances Control Act, and other statutes might be more effectively used in addressing the problem of agricultural chemicals in ground water. Among other efforts, OGWP and the Office of Pesticide Programs co-chaired an Agency-wide Pesticides in Ground-Water Working Group which conducted reviews of existing information and scientific knowledge on pesticide contamination. In FY 1986, OGWP issued two publications to disseminate the results of these investigations to Federal, State, and local officials who are involved in ground-water protection activities.

The first publication, Pesticides in Ground Water: Background Document, discusses the sources and extent of pesticide contamination, statutory authorities, programs that can be used to address the problem, and the impacts of pesticide contamination on human health and the environment. The second document, State Program Briefs: Pesticides in Ground Water, presents summaries of State activities related to pesticides in ground water. Since publication, these documents have been used extensively by all levels of government in developing programs to control pesticide contamination.

Within EPA, these initial efforts to examine the issues, potential solutions, and statutory authorities provided a major impetus for EPA's selecting the problem of agricultural chemicals in ground water as the focus for a major Agency-wide strategic initiative. In FY 1986, OGWP has actively participated in the various efforts to define the Agency's Agricultural Chemicals in Ground-Water Strategy, including an OPTS-sponsored workshop held last June at Coolfont, West Virginia.

## INVENTORY OF EPA SOURCE-RELATED ACTIVITIES

At a Congressional hearing on ground-water protection, EPA was urged to examine how its programs were addressing the 33 sources of ground-water contamination identified in an Office of Technology Assessment report. In the summer and fall of 1986, the Office of Ground-Water Protection responded to this concern by conducting a survey of all program offices at Headquarters and the Regions to determine the type, scope, and status of the Agency's regulations, guidances, and studies which focus on 33 sources of ground-water contamination. As a result of this effort, OGWP produced a report and automated data base inventorying approximately 270 EPA programs and activities that address these contamination sources, ranging from landfills to road salt application. They provide a basis for internal discussions about the Agency's agenda for addressing ground-water issues and facilitate OGWP's responses to Congressional and public inquiries. The report is being published for wide distribution.

## GOAL III: ESTABLISHING A CONSISTENT EPA POLICY

When the Office of Ground-Water Protection was established in 1984, one of the most serious gaps in protecting ground water was the lack of consistency among the many EPA programs with ground-water protection responsibilities. Each program addressed ground water in a different manner when setting prevention and clean up levels and addressing program priorities. To address this concern, EPA adopted a policy in the Ground-Water Protection Strategy which provides for differential protection of ground water. The Agency recognized that some ground waters require greater protection than others due to their particular use, value to society, and vulnerability to contamination. To implement this policy of differential protection, the Strategy called for the establishment of three classes of ground water which would serve as the framework for the establishment of this policy. In FY 1986, OGWP prepared draft guidelines for ground-water classification for public review in 1987. It also worked with various EPA program offices to incorporate the classification system into EPA's regulations and program guidance which affect ground water.

## GUIDELINES FOR GROUND-WATER CLASSIFICATION

In December 1986, the Office of Ground-Water Protection issued in the Federal Register for comment the Final Draft of the Guidelines for Ground-Water Classification Under the EPA Ground-Water Protection Strategy. The purpose of this guidance document is to further define the classes, concepts, and key terms related to the classification system as presented in the Strategy and to describe the procedures and information needed for classifying ground water.

The guidelines define three classes of ground water which are afforded different levels of protection or remediation. Class I ground waters are geographically limited and so vital to drinking water supplies or ecological areas that unusually restrictive environmental controls are required for protection. Class II ground waters include current and potential sources of drinking water and waters having other beneficial uses; they require a level of protection considered typical of EPA programs. Class III ground waters are not considered potential sources of drinking water and have limited beneficial use. They are affected by broad-scale natural or manmade contamination and require less stringent measures for protecting human health and the environment. The manner and extent to which the ground-water classification scheme will be incorporated into specific EPA regulation, permitting, and/or planning will be determined on a program-by-program basis.

In September 1986, OGWP initiated a case studies project to investigate how the proposed classification guidelines would be used in actual situations. The project focused on six sites where there is a facility (e.g., water treatment plant, uranium tailings dump) with the potential for contaminating nearby ground water. At each site, the ground water was categorized according to the classification guidelines. OGWP is currently preparing a report on the results of these studies.

## EFFORTS TO PROMOTE GROUND-WATER CLASSIFICATION IN OTHER PROGRAMS

OGWP worked with other program offices to incorporate the ground-water policy and classification guidelines into Agency regulations or program guidance which were under development. For example, OGWP worked with the Office of Emergency and Remedial Response (OERR) in applying ground-water classification to the implementation of the CERCLA National Contingency Plan. In its proposed guidance on appropriate removal and/or remedial actions at Superfund hazardous waste disposal sites, OERR incorporated classification as a means to determine clean-up levels and time frames. To carry out the Land Disposal Rule under RCRA, OGWP worked with the Office of Solid Waste in applying the classification guidelines to the ground-water use component of the guidance on Alternative Concentration Limits.

In its work within the Office of Water (OW), the Office of Ground-Water Protection assisted in the formulation of technical standards for sewage sludge disposal using a location-based approach to ensure proper siting in high risk Class I ground water. OGWP also reviewed and commented on OW's State reports on different types of UIC Class V wells which reflect the "interconnection" criteria of the classification guidelines.

For the Office of Pesticide Programs (OPP), OGWP participated in the development of an approach for regulating aldicarb. To ensure ground-water protection, the Office provided input to OPP s vulnerability assessment and regulatory options regarding the establishment of use prohibition areas. Similarly, OGWP collaborated with the Office of Radiation Programs (ORP) in the development of low-level radioactive waste standards and in the development of ground-water protection standards at inactive mill tailings sites.

In addition, OGWP participated in the development of a proposed rule on underground storage tanks by the Office of Underground Storage Tanks (OUST). The OUST refers to the Strategy's ground-water classes in the preamble to its proposed rule issued in March 1987. OUST is currently soliciting comment on whether EPA should adopt a regulatory scheme that would require secondary containment for tanks located in high risk locations. In determining high risk areas, the States would choose among three alternative definitions: areas meeting the criteria for Class I ground water as defined in EPA's classification guidelines; wellhead protection areas, as defined by States in their wellhead protection programs; and areas defined by an alternative State classification scheme which, at a minimum, includes the areas meeting EPA's criteria for Class I ground water.

## GOAL IV: COORDINATING THE DEVELOPMENT AND MANAGEMENT OF GROUND-WATER PROTECTION PROGRAMS

As the Ground-Water Protection Strategy was being formulated, it was clear that EPA's efforts to achieve a viable ground-water protection policy were impeded by the lack of coordination among the Agency programs dealing with ground water. The Agency also recognized that ground-water related decisionmaking was hampered by the need for adequate data about ground-water resources and more efficient systems for collecting, storing, and administering those data. To respond, the Strategy stresses the importance of coordinating EPA's diverse ground-water protection activities internally and with those of other Federal agencies and developing the tools for more effective data gathering and management.

Within the first year after the Strategy was issued, EPA established the Ground-Water Oversight Committee to provide policy oversight for the implementation of the Ground-Water Protection Strategy and the Agency's other ground-water protection activities. The Committee is chaired by the Assistant Administrator for Water and composed of other key Assistant Administrators and the Regional Administrators from Regions I and VIII. The Agency developed a ground-water monitoring strategy to identify the ground-water information needed by EPA and the States in their decisionmaking. At the

Regional level, EPA established Regional Ground-Water Coordinating Committees to develop and implement Regional policies to support the Ground-Water Protection Strategy. In most Regions, the Committee is chaired by the Water Division Director and includes the Directors for Hazardous Waste and Environmental Services and other key offices. In addition, EPA established a Federal Interagency Ground-Water Protection Committee to facilitate communication and coordination among representatives of Federal agencies with ground-water protection responsibilities.

During FY 1986, the Office of Ground-Water Protection built upon the collaborative relationships established in the previous year and achieved further coordination within EPA Headquarters and the Regional Offices and with other agencies and institutions in carrying out a number of projects affecting ground water. At EPA Headquarters, OGWP worked closely with ORD in the coordination of ground-water related research. OGWP also carried out efforts to implement the ground-water monitoring strategy which included conducting a ground-water data management requirements analysis, publishing the STORET manual for ground-water management, and developing criteria for measuring ground-water program effectiveness.

Through EPA's Regional Offices, OGWP assumed an increasingly significant coordinative role in Agency efforts to implement EPA programs affecting ground water and to administer section 106 State grants. With respect to inter-agency coordination, OGWP implemented a 1985 Memorandum of Understanding with the U.S. Department of the Interior.

## GROUND-WATER RESEARCH COORDINATION

EPA's ground-water research program is an integral part of EPA's Ground-Water Protection Strategy as it provides the data and information crucial to decisionmakers concerned with ground-water protection. Like other ground-water related activities, however, the research is supported by several offices, covers a wide variety of issues, and thus requires effective coordination. During FY 1986, OGWP supported ORD's effort to coordinate the ground-water research conducted by EPA's laboratories. As part of these efforts, OGWP participated in the first Ground-Water Program Review meeting last October which included research supported by four Assistant Administrators (Water, Solid Waste and Emergency Response, Pesticides and Toxic Substances, and Air and Radiation) and conducted in 3 laboratories.

More intensive two-day reviews were then conducted at the R.S. Kerr Laboratory in Ada, Oklahoma, and the Environmental Monitoring Systems Laboratory in Las Vegas, Nevada. The reviews focused on high priority ground-water research conducted by the Ada Laboratory, the Environmental Research

Laboratory in Athens, and the Environmental Monitoring Systems Laboratory in Las Vegas. The meetings were attended by EPA staff from program offices and the Regions as well as ORD staff from Headquarters and EPA research labs. As a result of these reviews, participants reviewed the value and utility of current research projects and set the stage for research planning and use for the coming years.

## EPA GROUND-WATER MONITORING STRATEGY

In FY 1985, OGWP developed with the other programs an EPA Ground-Water Monitoring Strategy which recognizes seven major objectives in carrying out monitoring activities:

- Characterizing the ground-water resource
- Identifying contamination problems
- Assessing known problems to support regulatory development and standard setting and respond to site-specific problems
- Assuring compliance with regulations
- Evaluating program effectiveness
- Improving data quality
- Developing ground-water data management systems.

In FY86, major activities were initiated to address these objectives. Several are highlighted below.

### Ground-Water Data Management Analysis

Information is clearly important in supporting ground-water related decisionmaking. In many jurisdictions, however, the data required by environmental managers do not exist. When data are available, they are often incomplete, and if computerized, incompatible with other systems. To respond to this problem, OGWP and EPA's Office of Information and Resource Management (OIRM) initiated a project in 1986 to identify the specific data needs of EPA Headquarters, the Regions, the States, and other Federal agencies.

By the end of FY 1986, OGWP and OIRM collected information on data needs from over 30 EPA Headquarters staff, 6 EPA Regional Offices, 18 States, and various Federal agencies. They are currently evaluating this information to determine who needs what types of ground-water data and for what purposes. When the evaluation is completed, OGWP and OIRM will produce a report and recommend alternative options to be considered in determining an EPA approach to improving the Agency's ground-water information system. Upon selecting an approach, the Agency will undertake a number of projects for improving EPA's ground-water data management capabilities.

## Storet Manual for Ground-Water Management

In another effort to implement the Ground-Water Monitoring Strategy, OGWP published a manual in March 1986 on the use of STORET, EPA's water quality data base system. The main purpose of the manual, entitled Ground-Water Data Management With Storet, is to help States use STORET in the storage and analysis of their ground-water data. It helps them to organize and gain access to the data stored in the system. The manual is a supplement to the STORET User's Handbook which was published in 1982. It is designed to be used with the earlier manual. OGWP is currently accepting comments and suggestions on how to improve the new manual to better reflect user needs. In addition, the Office is planning further efforts to make STORET a more useful tool for Regional and State ground-water managers.

## Workshop On Ground-Water Protection Indicators

As a further part of its efforts, OGWP sponsored a workshop in September 1986 which focused on the identification of indicators for measuring the effectiveness of EPA in implementing the Ground-Water Protection Strategy. Among other issues, the indicators relate to ground-water quality, sources of ground-water contamination, EPA and State actions, and the impacts of EPA and State programs on ground-water quality. The workshop was attended by approximately 33 participants representing EPA Headquarters, Regions, and laboratories; other Federal agencies; State agencies; technical and engineering firms; public interest groups; and private industry. By conducting this workshop, OGWP promoted significant exchanges of ideas and viewpoints on program evaluation from a wide range of constituencies involved in or otherwise affected by ground-water protection activities, and laid the foundation for testing and adapting indicators to determine the status and trends in ground-water contamination nationally.

## Memorandum Of Understanding With The Department Of The Interior

OGWP's efforts to work with other Federal agencies centered last year on EPA's Memorandum of Understanding (MOU) with the U.S. Department of the Interior. The primary objective of the MOU, signed on June 24, 1985, is cooperation and coordination between EPA and the U.S. Geological Survey (USGS) in ground-water quality. The MOU describes the roles and responsibilities of EPA and USGS in data collection and area investigation, technical assistance, and research. In July 1986, the two agencies issued a position paper which outlines four major issues. They include: relationships between EPA and USGS at the operational level, USGS' role in providing technical assistance to EPA, communication between research programs, and transfer of payments between agencies. With respect to the latter, OGWP and USGS initiated action in FY 1986 to develop a generic interagency agreement which would facilitate the conduct of personnel transfers and small ground-water projects.

Another provision of the MOU between EPA and the U.S. Department of the Interior is to carry out EPA's statutory responsibilities under the High Plains Aquifer Demonstration Program. It establishes a coordination committee composed of EPA, the Bureau of Reclamation, and the U.S. Geological Survey to carry out a plan for demonstration projects to determine the potential for artificial recharge of aquifers in the High Plains and other Western States. OGWP's participation in the High Plains Recharge Demonstration Program represents one of the first times that EPA has been involved in a Bureau of Reclamation program early in the planning stage.

## REGIONAL ACTIVITIES

The establishment of the Regional Ground-Water Protection Offices and Coordinating Committees provided the means for EPA to focus on specific activities that would further the goals of the Ground-Water Protection Strategy among the various Agency program offices and individual States in each Region. In FY 1986, the Regional Ground-Water Office evolved as a major focal point in each Region for coordinating the Agency's internal responses to ground-water issues and for providing guidance and support to the States in their efforts to develop ground-water protection strategies and programs, as well as respond to ground-water issues of particular concern.

The increasingly significant role of the Regional Ground-Water Offices and Coordinating Committees was evidenced in their use of the ground-water program as a mechanism for coordinating the entire Office of Water response to Superfund and other EPA program reviews in which ground water is a primary consideration. The Regions' major role in coordinating internal ground-water activities during FY 1986 also was demonstrated by their efforts to control pesticide contamination and improve Regional data management capabilities. With respect to the interface between EPA and the States, the Regional Offices of Ground Water were actively involved in a range of State ground-water protection efforts through the State Ground-Water Strategy Grant Program.

### Coordination with EPA Programs

During FY 1986, the Regional Ground-Water Offices intensified their involvement in the review of EPA program activities affecting ground-water, as evidenced in the Record of Decision (ROD) process for Superfund sites. In the past, the ROD report did not always adequately address ground-water concerns until a decision was about to be made. Consequently, serious ground-water issues arose which were very difficult and time-consuming to resolve. During FY 1986, about half of the Regional Offices instituted a more formal review process to ensure that ground-water considerations are thoroughly analyzed at the beginning of the ROD process so they could be fully incorporated into policy decisions affecting Superfund sites.

With respect to other EPA programs, the Regional Offices also significantly expanded their review, technical assistance, and coordination responsibilities. In Region IV, for example, OGWP conducted reviews for pesticides and RCRA activities to ensure greater emphasis on ground-water concerns. In Region II, the Office of Ground Water and the Ground-Water Coordinating Committee expanded their reviews and initiated intra-divisional agreements to ensure greater involvement in the Hazardous Waste Program, the Water Quality Management Planning Program, as well as the Superfund Program. Similarly, Region III signed and implemented an interdivisional MOU between the Water Management and Hazardous Waste Management Divisions of EPA. The MOU focused on the mapping of facilities located in the most sensitive areas of the Region and the development of a computerized list of ground-water contamination incidents. To reduce duplication, Region III shared each State's ground-water work plan with other States in the Region and formed a hydrogeologists group to discuss common technical and administrative problems among all Regional programs.

In other efforts, EPA's Regional Ground-Water Offices addressed concerns of particular relevance to a Region. The Regional Offices have undertaken a variety of activities during FY 1986 to evaluate the extent of pesticide contamination and to develop programs to control the use of agricultural chemicals. Region V, for example, outlined an approach to the development of a Regional strategy to define the scope of the problem and to reduce its potential for causing major adverse effects on human health and the environment. The Region's objectives are to develop an agricultural chemicals monitoring strategy for water supply wells, identify research needs, and develop information for enhancing State Extension Training Programs for farmers and applicators in vulnerable ground-water areas. Similarly, Region IX developed a pesticides in ground-water initiative. Its objectives are to identify State efforts in dealing with pesticides and to provide information to Regional staff and EPA Headquarters for consideration in developing work plans and national policies.

Other Regions addressed the pesticides problem primarily through efforts to educate State and local agency staff. For example, Region VII identified agricultural chemicals as the most important ground-water issue confronting its States. Thus, in June 1986, the Regional Office of Ground Water held a workshop for the four States in the Region on agricultural chemicals and State strategies. Region X stimulated interest in agricultural chemicals at the State and local level by performing its own ground-water monitoring to highlight contamination programs. The Regional Office also held a workshop on agricultural chemicals last October in Oregon.

The Regional Ground-Water Offices also focused efforts on State and local data management. Region II, for example, sponsored a workshop in the fall of 1986 to discuss the benefits of sharing data among State and local authorities and improving data management systems. Last February, the Region held a successful two-day data management workshop in Philadelphia to discuss and demonstrate existing data systems and related concerns. The workshop was attended by personnel from EPA's Washington Information Center, who demonstrated STORET capabilities; EPA Headquarters, who discussed the Agency's evolving data management policy; EPA Region III, who demonstrated a PC application; and several USGS districts, who demonstrated their PRIME computer system. The workshop provided a constructive forum for States, EPA, and the USGS to exchange ideas on data handling, future data needs, and near-term policy decisions.

During FY 1986, Region V's efforts centered on improving its data management capabilities. The Ground-Water Coordinating Committee developed a draft data management framework for the Region. In addition, the Region adopted a ground-water directory and organized three Region-wide data management training courses.

Based on the recommendations of its Ad Hoc Ground-Water Quality Data Management Committee, Region IX's Office of Ground Water instituted more effective data management to support decisionmaking related to ground-water protection and clean-up by providing improved quality control for data entry and an efficient system for data storage and retrieval.

In Region X, OGWP worked with the Pesticides and Toxic Substances Branch to identify ground-water areas susceptible to contamination and to correct pesticides usage data. In addition, the Region compiled data on the characteristics of water sources at various sites to provide information on specific aquifer conditions and other data useful for ground-water protection activities. It also encouraged and aided the States in the Region to integrate their data into a geographic-based information system.

In Region IV, a Ground-Water Data Management Group was established in FY 1986 to serve as a resource for State and

Regional ground-water data programs. The Group also provides support to Regional and Headquarters staff to facilitate the Integrated Data Program.

Regional Support to State Strategies and Programs

The State Ground-Water Strategy Grant Program provides an opportunity for each State to establish a ground-water strategy and conduct related work with EPA and other agencies. Through this program, EPA's Regional Ground-Water Offices work with every State in developing ground-water protection strategies and carrying out programs to support these strategies. A separate report on this activity has been issued.

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This is the second full year of EPA's ground-water protection program and a great deal of progress has been made in a variety of areas. Nonetheless, the most significant event during this period was the passage of the Safe Drinking Water Act Amendments authorizing the Wellhead Protection Program, which provides an opportunity to assist States in protecting their ground-water resources. In the next few years, EPA will be carrying out this new program as well as building upon its earlier efforts to implement the Ground-Water Protection Strategy.

Senator Bradley. Thank you. Which states do you think have model programs, and what might other states learn from them?

Mr. Jensen. I think the states that are most often cited as having been very aggressive in developing comprehensive programs are Florida, California, New Jersey, Wisconsin.

Those programs, and perhaps I should also mention the New England states as a whole, working on a regional basis, I think there is a good example there of a number of states coming together to address their common groundwater resource.

Each of those states' programs will vary significantly from the others. I think it is appropriate. In Florida, for example, you have a very shallow water table, very close to the surface of the ground.

You have generally very poor soils. You have rapidly expanding population, and their groundwater protection program is geared to their peculiar circumstances, which are not duplicated necessarily in the other states.

Some of the things that I would look for in a comprehensive state program, some of which will probably sound rather mundane, but I think need not to be overlooked. Certainly you have to look at the institutional capacity of the state to address groundwater.

Do they have their groundwater efforts split up under several departments, with no sort of unified sense of how they are proceeding? Do they have the appropriate statutory and regulatory authority to do the things which they need?

Is the program based on a sound understanding of that state's particular hydrogeology, of its particular groundwater problems?

We think as well, just as we have done at the Agency, that a state strategy that has some method of classifying groundwater, some method of differentiating between the different aquifers and the different uses to which groundwater may be put, that that is a useful tool in any comprehensive program.

And then what is probably the most difficult question to answer, but one which obviously a state would need in developing a program, and that is, what level of protection are you going to give to your groundwater?

And how does that translate into specific regulatory activities? Do you control point sources with some sort of technological fix? Do you have a broad and comprehensive zoning effort, where you basically control the use of the land surface, more perhaps than the actual source itself?

Those types of questions would obviously have to be asked and answered by a state in addressing its groundwater problem.

Senator Bradley. If you agree with the previous witnesses that it is much easier to prevent a contamination of an aquifer, say, than it is to clean it up, would that not necessarily imply greater land use planning?

Mr. Jensen. Well, I certainly agree that as a general principle, prevention makes more sense in developing a protection program here.

But I do not think that necessarily means greater land use control. It depends on the source of contamination. Certainly Congress in addressing the problem of how we should manage hazardous wastes in this country has designed a program that you would not describe necessarily as broad land use control.

Certainly there are some instances of that. You are making your siting decisions, you are making some land use decisions. But it is not a broad zoning approach to hazardous wastes.

So I think you really need to ask, what is the particular source of contamination? Who are the people or what are the activities that you are trying to regulate? And from that analysis will come, I think, an indication of whether it would be best to use land use control or perhaps some other means.

Senator **Bradley**. But you agree that if you take the hazardous wastes example, it is a matter of managing the production and monitoring and disposal of hazardous wastes in addition to siting.

But put that in one basket. And the other basket is, how much we actually know about how to clean up contaminants. It seems to me that one of the things that was clear from the earlier testimony is, there is this whole range of organic compounds and heavy metals which we have not even monitored.

And that relate to aquifers generally, and broadly dispersed activity. I would assume that would have to be something related to land use, until we are able to figure out what the problem is, and how do we cope with the problem?

Mr. **Jensen**. I think certainly there is something to be said for recognition of our own ignorance, when it comes to the groundwater resource, and that might argue for a broad, preventive program, simply because we are not fully certain of what the effect of this contamination might be once it gets into the groundwater.

Senator **Bradley**. I have some more questions, but, Senator Evans?

Senator **Evans**. Thank you, Mr. Chairman. You mentioned in your earlier remarks that we are probably not at a crisis stage, in terms of our groundwater, generally.

But I wonder, in light of some of the previous testimony, in the speed with which groundwater moves, and presumably the speed with which contaminants find their way through the earth into groundwater supplies, is it possible that we have some ticking time bombs out there that have already happened but that we have not yet detected?

Sort of the earth equivalent of the astronomical observations where we see a supernova, but it is an event that happened millions of years ago and we are finally seeing what happened.

With the heavy use of pesticides in relatively recent years, is it possible that those pesticides are already in the ground and being carried slowly toward groundwater tables and contaminations of large aquifers?

Do we have any knowledge or idea of what is happening in that respect?

Mr. **Jensen**. It is certainly possible, and I think the lag time factor is one that needs to be taken into consideration in formulating groundwater policy.

Let me say with respect to pesticides specifically, we share your concern and have initiated this year, in fact, at the agency a national pesticides in well water survey, which we have designed to give us, we hope, a much better picture of just how serious, or perhaps how not serious, this question of the leaching of pesticides into our groundwater supplies is.

We are currently taking samples in three states on a pilot study basis to verify the design of our study. And if those results satisfy us, we will be expanding this survey next year to a truly national scope.

And we would hope by 1989 to have a much clearer picture of the threat that pesticides may pose to our groundwater resources.

Senator EVANS. Does that set of studies include such things, for instance, as a situation where you may have an important aquifer that makes up the groundwater, and the top of that aquifer, or the groundwater table may be, say, 30 feet below the surface? Assume it is an agricultural area on which pesticides have been used regularly over an extended period of time. Is there any research being done, or any investigation, as to the leaching of those pesticides into the soil, and how closely they may have been carried down by rainfall and by the trickle into the aquifers?

It is, one thing to measure what is already in the aquifer and how pesticides may or may not be rising or changing in their incidents in the groundwater. But how about getting to the groundwater? What do we know about that? Or are we doing anything to find out?

Mr. JENSEN. Yes. There are several things underway. I think the survey itself will give some answers to that set of questions.

In designing the survey we took into account several things. One is the leachability of the particular pesticides that we are studying. The hydrogeology of the area where we have chosen to study. The patterns of crop use. Just how much pesticides over a historical period have been used in this area.

So I think we will get some information that goes to that. But perhaps more directly, the information about pesticides generally will come as a result of the registration process under FIFRA, where in order to get a FIFRA registration we are requiring more and more information from the applicant about the leachability in different types of soils and what not, of the particular pesticide that the applicant is seeking to register.

So there are some things being done that will give us a better picture of that.

Senator EVANS. Those are all peripheral to my question. Maybe it is not an appropriate kind of research. Maybe it does not tell us anything.

But it just seems to me that if there are excess pesticides leaching into the soil, and there is some distance between the surface level and the groundwater table, then it may well be an important question to know with what speed those pesticides work their way toward the groundwater.

They may not have gotten there yet. But the pesticides of past applications may be that ticking time bomb that inevitably, and maybe at some even predictable time, will get to groundwater.

And even if we totally banned pesticides in that area from now on, there would still be a very significant problem that will pop up and hit us in the face 10, 15, 20 years from now.

Is there any kind of research that we can do that will give us information on that? And if so, are we doing it?

Mr. JENSEN. Unless I completely misunderstood your concern, I think the activities I described will give us information that is relevant to your concern.

With respect to specific sites, I am not aware of specific site-by-site investigation of an area where perhaps we have the situation that you described.

Senator EVANS. It seems to me that what you have said is that under FIFRA you are going to be more careful in ensuring that future pesticides are not leachable.

At least you are taking into account the potential of these pesticides, if you are going to register them, and ultimately becoming a contaminant in the groundwater. I presume that is what you are saying.

Mr. JENSEN. Yes.

Senator EVANS. But the measurements, or the testing that you are doing for pesticides are taken from wells which in themselves are drawing water from the groundwater table. Is that correct?

Mr. JENSEN. That is correct.

Senator EVANS. So it seems to me that you are missing totally the kind of thing I am mentioning. Unless it is simply either not doable or not a problem.

Mr. JENSEN. Again, I think that the survey is going to teach us about the very problem that you are getting at. And that is, what is the rate of the pesticides already in the soil, in terms of its threat to ultimately getting into groundwater.

Senator EVANS. What are the specific surveys that you are doing that will tell you that?

Mr. JENSEN. If you study the actual wells in which pesticides are showing up.

Senator EVANS. Okay, but take an aquifer where you know very well, broadly throughout that aquifer there has been intense use of pesticides over a period of time.

All of the current testing you do of the well shows no pesticides. Does that tell you that there is no problem? Or no potential problem?

Mr. JENSEN. It does not give you the ultimate answer. But it does tell you, by the absence of the pesticides in that well, and by an understanding of the soil conditions, the type of pesticides that have been applied, the time of travel of the groundwater in that area, it does begin to give you an answer to the question of whether you might ultimately expect that those pesticides which have not yet shown up in the well water might someday do so.

Particularly when you take that evidence and compare it with the evidence that you have gathered on a national scale. I think it is going to tell us a great deal about the rate of pesticides traveling the different soil types, and getting into the ground water.

I do not mean to sound argumentative. I think there is value to the survey, with respect to the question that you asked. It will give us some sense of where to expect, or even to predict, that we might have that ticking time bomb that you describe.

Senator EVANS. Nobody has ever drilled a well, or a core drilling, for instance, of the earth from surface down to the groundwater level, and take soil samples at various levels to see how far the pesticides may have leached?

Mr. **Jensen**. Perhaps Ms. Mlay is aware of some research of that type. I am not.

Ms. **Mlay**. Yes. There is exactly the kind of research taking place now, primarily in our Athens laboratory.

They focus essentially on Vadose zone which is that area above the water table between the surface of the ground and through which pesticides do travel. They are developing models to predict the extent to which the contaminants flow downward into the water table, and the relationship between that and the usage and what ultimately would go into the water table.

That work is underway. We certainly have a lot to learn about it. But we are attempting to factor that into registration decisions so that we understand what degradation, or how much contaminant would finally endup in the water table.

But it is pretty new. There is a lot to learn.

Senator **Evans**. I want to just briefly ask the USGS representative, that may be out of your ball park in terms of pesticide contamination. But what about that kind of research?

Is it useful in terms of whether it is pesticides or anything else? In terms of telling you anything about the potential of something that is already loaded into the soil and its arrival at the groundwater.

Mr. **Frederick**. We think that is a useful question to ask. We are set up for doing some research in that area.

I think maybe we are even cooperating with the EPA Athens laboratory and the Agricultural Research Service on that particular issue. Some of our basic research is directed into that area also.

And I expect that will expand over the next few years. We have been approached by Agricultural Research to maybe expand programs with them and with EPA.

Senator **Evans**. Under your state cooperative arrangement, under your groundwater monitoring strategy, you have given grants to states.

At least a certain share of them, I understand, from reading this report, are for developing and bettering their own database and analytical ability for groundwater measurement, in terms of quality. Is that essentially correct?

Mr. **Jensen**. Yes.

Senator **Evans**. How large a program is that? Approximately what amount of money per year would go into that program, and be utilized?

I understand the program is broader, and be used for other things, but would be going into that, the assistance to states and local communities in developing better recordkeeping and data gathering on ground water quality.

Mr. **Jensen**. In the last 3 or 4 years we have given to states between $6 million and $7 million a year, to assist them in the development of their groundwater strategies, which of course would encompass more than the activities that you have described.

So it would be some portion of that annual figure that would be assisting the states to address that problem.

Senator **Evans**. The $6 million to $7 million is on a national basis?

Mr. **Jensen**. Yes.

Senator EVANS. Do you attempt to either require or set forth some national standards for data collection, in terms of water quality and the kinds of things that you are attempting to search for in the water in terms of pesticides and other contaminants, so that you are getting consistent information from the states?

Ms. MLAY. That is also evolving, because collecting data for pesticides, for example, and collecting data associated with hazardous waste sites is somewhat different.

The Agency has just issued a new manual on data collection hazardous waste sites. And part of the output from this pesticide survey that Mr. Jensen has just mentioned will be a set of improved methodologies in collection of information on pesticides.

It is very fast-moving. It is hard to say, "here is the manual," because tomorrow somebody will have discovered a new method.

Senator EVANS. But are you focusing this at or around identifiable hazardous waste sites only?

Ms. MLAY. No. What I am saying is that, you have asked about developing these methodologies, and I am saying that a lot of information is evolving out of those activities because they so intensively need good methodologies.

As a consequence of the hazardous waste program, methodologies are being developed that have utility for other purposes. The pesticide survey is focusing in on test methodologies for pesticides.

Senator EVANS. What degree do you need good information on contamination of groundwater to carry on the responsibilities of EPA? What degree do you get into that as a problem that needs correcting?

Mr. JENSEN. Well, certainly in making the decision under RCRA and Superfund, there is substantial need for accurate, good data about the groundwater resource that is going to be impacted by that decision.

Similarly, in our administration of the underground injection control program, we are in need of site-specific data that will allow us to make appropriate permit decisions on the use of those wells.

So we have several regulatory programs that require us in an ongoing basis to have good groundwater data to support the decisions that we have to make.

Senator EVANS. Did you carry on this kind of monitoring of groundwater quality directly? Or is all of that done through the state and local communities of whatever cooperative programs you have?

Mr. JENSEN. Again, that varies from regulatory program to regulatory program. We do not have a national groundwater monitoring network independent of our regulatory programs.

All of the monitoring that we do, for the most part, is as a consequence of the regulatory needs that we have. Perhaps the most comprehensive monitoring results come from our administration of the Safe Drinking Water program.

There, public water supplies which are using groundwater are required to monitor on a regular basis for the contaminants for which drinking water standards have been established, and to report to the state or the Federal Government, as appropriate, when those contaminants are showing up above certain levels in the water that they are drawing from the ground.

Senator **Evans**. What degree do you have cooperative programs with USGS in this monitoring and data gathering?

Ms. **Mlay**. Well, there are a number of things that we do together. For example, on the pesticide survey, they are providing technical support in helping us determine the extent to which contaminants occur because of the hydrogeology in the given area.

So we are sorting out the various wells we tested, by characteristics, so that if we find or do not find pesticides, we can make some correlation.

We also draw very heavily on the basic methodologies that USGS develops for research purposes, and then adapt them to our own use. The models and the test methodologies that we use in our regulatory programs, are drawn from USGS's very large source of information.

They are also cooperating with us in Superfund sites by coming in and looking at specific problem areas and conducting research case studies to identify new ways of approaching problems.

We do not use them as a contract lab to do all our monitoring for us. That would be a terrible waste of a unique scientific capability. But our relationship is generally on working through a problem and developing research programs and new methods that will help us do our job better.

Senator **Evans**. It sounds to me like the, at least from what I have detected so far, I may be way off, but it sounds to me like under the state and Federal cooperative program run by the USGS, there is $100 million a year going into that program, that that is by far the biggest and most consistent database for groundwater contamination that exists in the country.

Is that an accurate understanding?

Ms. **Mlay**. In characterizing the overall resource, yes. In terms of specific sites, we would have much more intensive information around areas where we regulate or where we are cleaning up, as a consequence of the kind of data collection that we do.

So ours is a different type of data. Their data tends to be broader based. Our data tends to be focused on specific areas.

Senator **Evans**. Do you consistently share that specific information that you have gathered with USGS?

Ms. **Mlay**. Yes. As Phil Cohen mentioned, our two databases are interactive. And we are working with our programs and with the states to try to get even better use of the system that we use as the repository for this data, so that it can be shared and it can be made available.

Senator **Evans**. Do you see any places where that coordination is inconsistent or where there are holes or where somehow we need to do things in a better fashion? Or are you satisfied that it is working as well as it needs to work?

Mr. **Jensen**. I think Mr. Frederick's comments were quite appropriate. We generally feel that the relationship is a very good and positive one.

But I think both of us have indicated to you the sort of natural tension between our need to make site-specific regulatory decisions on an ongoing basis, and their longer range, sort of research orientation to groundwater.

I think that is an appropriate tension, and I feel the relationship is a good one.

Senator EVANS. I am not sure I would characterize it as tension. It just seems to me that that is most cooperative. I mean, you start with the large and work toward the focused problems and correction of the problems.

I am not sure there should be any tension. It seems to me there should be a high degree of partnership in that effort. Maybe the tension is in not too much money, and both sides wanting more.

Mr. JENSEN. Tension or not, I think it is healthy. It is a productive relationship.

Senator EVANS. Okay.

Senator BRADLEY. You have not had any case where you wanted information on a site and USGS was not able to give it to you in a timely manner, and that that affected your decision?

Mr. JENSEN. I am not aware of any examples of that type.

Senator BRADLEY. The aquifers do not recognize state boundaries. And if you have a problem with an aquifer that goes across state boundaries, does there not have to be a Federal role in interstate groundwater problems? And what do you recommend?

Mr. JENSEN. Not necessarily.

Senator BRADLEY. I mean, if you have one state that has a great program, and the next state does not have a very good program at all, and they share the same aquifer, that is a problem.

Mr. JENSEN. That can be a problem. What I meant to suggest is that, obviously the first place you ought to look for resolution of that type of a difference is to the states themselves.

I do not think it necessarily means that the Federal government needs to step in and mediate. Certainly we have abundant examples of interstate cooperation and agreements specifically related to water resource problems that I think teach us that it does not necessarily require the Federal government to step in.

Senator BRADLEY. What are your biggest concerns nationally in terms of chemicals, or in terms of organic substances that are moving through and into the groundwater?

Mr. JENSEN. The largest concern we have presently is the use and application of agricultural chemicals generally to the land.

And as Senator Evans pointed out, we still have a great deal to learn about that. But the use of those chemicals is so widespread and is more difficult than discreet point sources to regulate. I think that is one place where we have sort of lagged behind in deciding exactly how to address the situation.

Senator BRADLEY. So Mr. Cohen's nitrate map is of real concern, because it implies that if nitrates are there, because of the use of fertilizers in these areas, intensively over a long period of time, it is likely that other things are there.

Mr. JENSEN. That may well be. I cannot speak as a scientist in answering that. But certainly we are sufficiently concerned that we have initiated this survey of pesticides in well water.

And we are also currently developing in the Agency what we refer to as an agricultural chemical strategy.

Senator BRADLEY. An agricultural chemical strategy. Well, now here we have worked over a long period of time and have identified specific areas.

Now, what other than nitrates do you think are serious problems that might flow from this kind of use of agricultural chemicals over many, many years? And what are you doing to detect whether they are moving toward groundwater? Either one of you.

Ms. **Mlay**. The Ag Chemicals in Groundwater Strategy is an attempt to look at all of the authorities that we have in EPA, including FIFRA, Safe Drinking Water Act, and disposal authorities, and things that we can do on a technical assistance basis. Give more information to people so that they can use it to make wise decisions.

In the agricultural chemicals in groundwater survey we are looking at about 70 or 80 different pesticides, to see the extent of contamination.

Senator **Bradley**. Now where is that? You are looking at it where?

Mr. **Jensen**. We have designed a survey that we hope will give us a national picture.

Senator **Bradley**. So that you have now a strategy already formulated, and you have requested data from various places around the country.

At the end of *x* period of time that data will come in, and you will be able to tell us whether, on the basis of 70 separate chemicals, there is the same problem as Mr. Cohen indicated in nitrate.

You have done all that work, and we are just now waiting for the data to come in.

Mr. **Jensen**. No. We are in the beginning stages of the survey, actually going out to the identified wells across the country, taking the samples, analyzing them, plotting the results.

Senator **Bradley**. How many wells are there that are involved in this, so that you get a national picture?

Mr. **Jensen**. In the initial pilot study, which is currently underway, we will be taking samples, I believe, in 150 wells in three different states.

In the national survey, which would follow next year, I am sorry, it escapes me at the moment how many wells would be involved.

Senator **Bradley**. Those three states are?

Mr. **Jensen**. California, Minnesota and Mississippi are the three states.

Senator **Bradley**. California, Minnesota and Mississippi. What is the rationale for Minnesota and Mississippi? I can see the rationale on California.

Mr. **Jensen**. Again, the factors that were——

Senator **Bradley**. These are agricultural chemicals.

Mr. **Jensen**. These are agricultural chemicals. And we take into account the type and amounts of chemicals that have been used in particular areas.

Senator **Bradley**. Okay.

Mr. **Jensen**. The hydrogeology varies, of course, from state to state.

Senator **Bradley**. So that you will have a pilot in these three states for a year.

Mr. **Jensen**. The pilot will be complete this fall. And we would hope soon that the pilot verifies the validity of our procedures to have the full-blown survey on a national scale next year, with the final results available in 1989.

Senator **Bradley**. So the final results nationally on 70 separate pesticides would be available in 1989?

Mr. **Jensen**. Yes.

Ms. **Mlay**. It is a statistically designed sample to tell us overall the extent of contamination nationally. Not at any given individual point. But we have tried to relate it to crop usage and so that we know the percent, and average levels of contamination.

Senator **Bradley**. And you will be able to say also, based upon areas that have heavy irrigation, areas that do not have heavy irrigation, areas that have *x* amount of rainfall, et cetera.

Mr. **Jensen**. Yes. We hope it will have a substantial predictive capacity. Once we get the results we will be able to pinpoint areas where we might expect to find problems with pesticides in the water.

Senator **Bradley**. If you are looking at a national groundwater policy, you say you have brought together all of these separate authorities under your control, laws under your control, and you now have a national groundwater strategy.

Do you think there needs to be any further legislation related to groundwater?

Mr. **Jensen**. We certainly do not see the need for an expansion of the Federal regulatory authority.

We have wondered, given the variety of statutes that currently address groundwater whether there might not be a need, perhaps in legislation, to do the same sort of thing that we did at the Agency, and that is try to make the application of those statutes more consistent.

I think inevitably the statutes arising in the different committees of Congress are going to suffer from some inconsistencies. And we have recognized that at the Agency, and we think it has improved our administration of those statutes to have tried to articulate a guiding set of policies at the Agency level.

We are certainly considering whether it might not be appropriate to have some national statement from the Congress as well.

Senator **Bradley**. Now, when you do this national pesticide study, is this done at all in any kind of cooperation with USGS? I mean, are you consulting on this?

Ms. **Mlay**. Yes. They are providing technical support to us and identifying hydrogeologic aspects. They have reviewed the protocols that we are using. We are having people in the states do the actual testing.

Senator **Bradley**. So that it is a joint effort.

Ms. **Mlay**. Yes. They are very much involved with us on it.

Senator **Bradley**. On the problem of point source pollution, the hot spots, et cetera, who decides how to clean those up?

Let us say you have a hot spot, let us say it is under Superfund, or let us say it is under some other authority, is there a central repository of methods for ameliorating a hot spot?

Mr. **Jensen**. I do not have direct responsibility for Superfund and——

Senator **Bradley**. With regard to groundwater. I mean, it is groundwater pollution. Right? Contamination of groundwater.

Mr. **Jensen**. But the principal authority for cleaning up groundwater that is administered at the Federal level is Superfund, and I am just not familiar enough with the specifics of how those actual decisions are made under that statute. We would be happy to provide that.

Senator **Bradley**. So you are saying that, you do not think about cleaning things up. You only think about identifying where things are.

Mr. **Jensen**. In the Office of Water, which I have responsibility for, we do not have direct authority to go out and spend money to clean up the groundwater. We do make decisions which would prevent groundwater contamination in the first instance. But we are not involved in cleanup activity.

Senator **Bradley**. Do you work with the Superfund people?

Mr. **Jensen**. Yes. In fact——

Senator **Bradley**. They might ask you a few questions, for example?

Mr. **Jensen**. Excuse me?

Senator **Bradley**. They might ask you a few questions, for example?

Mr. **Jensen**. Well, I was going to say that I was in Atlanta yesterday in one of the regional offices. And there the groundwater personnel out of the Office of Water have become the experts, if you will, in advising Superfund about their cleanup decisions.

So there is substantial integration of the expertises of the different programs.

Senator **Bradley**. Okay. Well, let me thank you for your testimony. I think that it has been very helpful. I think we have begun to look at this groundwater issue now.

We can come back to it, and I hope that you will be available for the committee at a future time.

Mr. **Jensen**. Would be happy to.

Senator **Bradley**. And the record is open for two weeks to allow for agency responses to any further questions, if there are any. Let me thank you very much.

Mr. **Jensen**. Thank you.

Senator **Bradley**. The hearing is recessed.

[Whereupon, at 11:50 a.m. the hearing was recessed to reconvene Thursday, June 18, 1987.]

[Subsequent to the hearing the Department of the Interior submitted the following:]

United States Department of the Interior
BUREAU OF RECLAMATION
WASHINGTON, D.C. 20240

JUN 30 1987

IN REPLY REFER TO: 725

Honorable Bill Bradley
Chairman, Subcommittee
on Water and Power
Committee on Energy and
Natural Resources
United States Senate
Washington, D.C. 20510-6150

Dear Senator Bradley:

In response to your letter of June 8, 1987, we are pleased to provide you with information on the status of the activities of the Bureau of Reclamation pursuant to P.L. 98-434, the High Plains States Groundwater Demonstration Program Act of 1983.

As you are aware, the Program was authorized in September 1984, and funds were made available to carry out the planning and site selection activities of Phase I in November 1985. As required in the law, the Bureau of Reclamation submitted a 6-month progress report to Congress in June 1986. Potential projects were identified in the report based on informal surveys of our State contacts in the Governors' offices. Since June 1986, 41 proposals have been received from 16 of the Western States. No proposals have been received from North Dakota.

To maximize non-Federal involvement and commitment, proposals were solicited from non-Federal entities. To ensure that individual State policies and program priorities were recognized in the development of the Program, the Governors reviewed and prioritized the proposals located within their States, and submitted them to Reclamation in July 1986. The Governors' transmittals were a critical step in the planning phase, as their prioritization of proposals helped ensure that each State's particular program direction was considered in the site selection recommendations for Phase I.

The technical evaluations of each of the proposals were conducted by Reclamation, the U.S. Geological Survey (USGS), and the Environmental Protection Agency (EPA). This process included USGS evaluation of the hydrologic and geologic aspects of proposals including the monitoring plan; EPA review of the plans for monitoring and evaluation of general water quality impacts from artificial recharge; and Reclamation evaluation of engineering, economic, environmental and legal aspects of proposals, and public acceptability.

A draft recommended plan, which includes 21 demonstration sites as required by the Act, has been formulated. Twelve of the sites are in the High Plains States and nine of the sites are in the other Reclamation Act States. In keeping with the emphasis on the cooperation and partnership cornerstones of the Program, the draft recommended plan is being reviewed by the States, project sponsors, and Reclamation's Federal partners prior to finalizing the plan which will be recommended to the Secretary of the Interior and to Congress.

The law mandates that the Secretary of the Interior transmit a final report to Congress containing the Commissioner's recommendations for demonstration projects to be designed, constructed, and operated during Phase II of the Program. This final report is due within 24 months after the enactment of the appropriation act initiating Phase I, which will be approximately December 1, 1987. At this time, we expect to meet that target date.

The success of the High Plains States Groundwater Demonstration Program is based on establishing effective working partnerships with the States and other Federal agencies. Each Governor designated a representative to work with Reclamation. The State representatives reviewed the concepts included in the site nomination and site selection process and provided ideas and information which were incorporated into the evaluation process. They worked with potential project sponsors to develop proposals and to assure each Governor's prioritizations were sent to Reclamation.

Reclamation recognizes the expertise of the USGS in collecting and analyzing groundwater data and continues to rely on the USGS's research and data collection network to support the development of solutions to groundwater problems. The EPA, through its responsibilities to protect water quality, defines the existence of environmental contamination problems and regulates sources of contamination. Reclamation provides a link by working with various groups which may have widely divergent views on problems, needs, and solutions. Reclamation elicits local advice on shaping alternatives and developing mutually acceptable decisions.

The Bureau of Reclamation is proud of the High Plains States Groundwater Demonstration Program. It exemplifies the work of Reclamation in problem-solving and practical application in addressing groundwater generally, and artificial recharge as one of many tools in water resources management. Reclamation recognizes and strongly supports the principle that States have primary responsibility for groundwater allocation, management, and protection. Our goal is to support State, regional, and local entities in defining their groundwater problems and needs, formulating and analyzing alternatives, and selecting and achieving the best solution based on social, political, legal, institutional, economic, and technical considerations.

If you have further questions regarding the High Plains States Groundwater Demonstration Program and the role of Reclamation, please feel free to contact me.

Sincerely yours,

C. Dale Duvall
Commissioner

# GROUNDWATER-RELATED PROGRAMS OF THE USGS AND THE EPA

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THURSDAY, JUNE 18, 1987

U.S. SENATE,
SUBCOMMITTEE ON WATER AND POWER,
COMMITTEE ON ENERGY AND NATURAL RESOURCES,
*Washington, DC.*

The subcommittee met, pursuant to notice, at 9:30 a.m. in room SD–366, Dirksen Senate Office Building, Hon. Bill Bradley, presiding.

## OPENING STATEMENT OF HON. BILL BRADLEY, A U.S. SENATOR FROM THE STATE OF NEW JERSEY

Senator BRADLEY. The hearing will come to order. This is the second in a series of hearings before the Subcommittee on Water and Power on the development of a national strategy for preserving and protecting our groundwater sources.

To accomplish this, the Subcommittee has chosen to focus on the current water programs of the United States Geological Survey and the Environmental Protection Agency and to assess whether they are adequate to address our groundwater needs.

In the last hearing, we heard from the two Federal agencies with primary responsibility for the Nation's groundwater resources, the EPA and the USGS. Today we welcome testimony from non-Federal witnesses.

I am confident that the Committee will benefit from the experience of non-Federal agencies and other expert witnesses in protecting and managing our groundwater resources.

I welcome suggestions from today's witnesses as to how the Congress may direct the appropriate Federal role in protecting groundwater resources and how to improve current Federal groundwater programs.

The testimony of the USGS and the EPA suggests some very, and I underline very, preliminary conclusions. First, while we are not in a crisis situation, we are at a threshold. The choices we make today are crucial for the best management of our groundwater resources. Over 120 million people and 90 percent of rural America rely on groundwater. The absence of adequate planning will place in jeopardy our future, and we simply cannot allow that to happen.

Second, the prevention of contamination is the key element in any long-term protection plan for groundwater resources. We know from experience the extreme cost and near impossibility of cleaning up already contaminated aquifers. We cannot afford to pollute our groundwater today. The price we would have to pay tomorrow would simply be too great.

Finally, we need to augment and restructure Federal research and data gathering programs in order to provide information to decisionmakers. As we heard at the last hearing, too little is known about this vital resource.

As far as USGS is concerned, Mr. Doyle Frederick, the Associate Director, essentially told the Committee that USGS does not manage, regulate or establish policy pertaining to groundwater issues. He described the role of USGS as one of defining the resources available; in other words, charting the supply.

Mr. Lawrence Jensen of the EPA went even further in describing the relationship of the EPA to the states by saying that, first and fundamentally, the EPA recognizes that the primary role in the protection of groundwater should lie with the states. Quite frankly, these are the views of the administration, and if any of the witnesses today hold views to the contrary, I hope you will make that clear to members of the Committee in a clarity of which I know you are capable.

I would also note for the record the apparent satisfaction on the part of the two agencies at the level of funding requested in the President's budget; yet, both agencies clearly pointed out the need for increased efforts in quantification and analysis of groundwater resources.

I can only assume that this apparent conflict is the result of the heavy hand of OMB in the preparation of the testimony or perhaps some other equally legitimate explanation.

[Laughter.]

Senator BRADLEY. Both agencies acknowledge the need for further basic research in order to assess our groundwater requirements and develop sound policy. I hope that our witnesses today will shed a little light once again on how we in the Congress can help overcome the lack of understanding of this most important resource and how we can facilitate ongoing efforts.

It is incredibly important. As I said, 90 percent of rural America and 120 million Americans depend on it, and so I look forward to today's testimony. We should take full advantage of this opportunity to build a consensus strategy for groundwater preservation.

We are going to structure this in a series of four panels today. The first panel consists of Mr. D. Craig Bell, Executive Director, Western States Water Council, Salt Lake City, Utah; Mr. Robert E. Moore, Assistant Deputy Commissioner, Connecticut Department of Environmental Protection. They will be accompanied by Mr. Hugh Thomas, Director of Natural Resources of the Connecticut DEP.

Gentlemen, please take the table, and welcome to the Committee. Try to, if you could, limit your testimony to 10 minutes if it is possible. If it is not, then just go on, and if it seems interesting you can keep going the rest of the hearing. If it bogs down, I will interrupt you; but you will not face that problem if you can limit it to 10 minutes.

## STATEMENT OF D. CRAIG BELL, EXECUTIVE DIRECTOR, WESTERN STATES WATER COUNCIL

Mr. **Bell.** Thank you, Mr. Chairman. The Western States Water Council is an organization comprised of representatives appointed by the governors of 15 western states.

Senator **Bradley.** We have a little problem with these microphones. If you could speak into the microphone, I think that would make it easier.

Mr. **Bell.** We consider a broad range of water policy issues; that is, issues relating to the management and protection of water resources in the west on behalf of the governors. None is more important than the issue of groundwater quality protection and management. So we have considered that issue for some time.

Indeed, under the leadership of a special subcommittee, we are continuing to consider what our position should be with respect to this important issue. So I expect that there will be forthcoming from the Council other policy statements and proposals to this Subcommittee and other committees in Congress.

My statement today is based on previous Council positions and basic principles which we have agreed on as well as a report which we have prepared summarizing State capabilities with respect to groundwater quality protection.

First of all, I would certainly agree that groundwater is a critical resource, especially in the arid west. The greatest use by far is for agricultural purposes; however, it is also an important resource for industry and mining. Furthermore, half the citizens in the west depend on groundwater for municipal needs, and in some areas that figure is much higher.

So I believe westerners by and large appreciate the significance of groundwater and want to take the necessary steps to assure its quality to allow for continued beneficial uses.

Groundwater management, that is the protection of its quality and the allocation of rights to its use, requires careful coordination among all levels of government. Historic Federal policies have recognized the primacy of states in administering groundwater allocation and quality protection programs.

Consistent with that policy, states have developed programs which address those two facets; that is, allocation of groundwater rights and groundwater quality protection.

The western states are geographically and economically different, and so it is understandable that western states' institutions for groundwater protection also differ; however, it is important to realize that every western state has such an institution.

Some State plans categorize groundwater into classes and establish standards, both discharge and ambient, aimed at protecting each class.

Some designate critical groundwater recharge areas and formulate regulations aimed at their protection.

Regulation of the underground injection of hazardous waste is accomplished in every state, either under the Federal Underground Injection Control Program or pursuant to State injection control laws.

Regional enforcement mechanisms are included in some State groundwater protection programs, as are public notice and participation practices with regard to permitting activities.

Some states are formulating programs to address previously unaddressed sources of groundwater pollution.

In addition to State groundwater quality programs, virtually every western state has a program in place to govern groundwater allocation. Generally an application must be submitted to the appropriate State administrative board or agency. That board must rule on the application based on criteria which differ from state to state. Once a permit is issued, the permittee has the legal right, which is a constitutionally protected property right, to use water for designated beneficial uses.

There is widespread agreement, I think, among everyone concerned with this issue that states should continue to have the exclusive role with respect to the creation and administration of groundwater rights. It follows that any Federal proposal should be built on the proposition that we should not interfere with that traditional State responsibility to allocate groundwater rights.

We also submit that with regard to groundwater quality any proposals for Federal groundwater legislation should recognize that groundwater protection is also a primary responsibility of the states and be supportive of that State role. We submit it would be inappropriate for Congress to enact legislation mandating rigid requirements for states to meet which may not be applicable for that state or even in an area of the country. Any national policy we submit should be based and built upon individual State strategies and responsibility for groundwater use, management and protection.

Western states are carrying out their responsibilities to protect groundwater in a number of different ways. Further, a number of states are in the process of restructuring their programs.

The Council prepared a report entitled Western State Groundwater Management and published it in October of last year. It catalogs state by state the State program with respect to groundwater quality and quantity. That was an update of an earlier report in 1982 and contained significant changes resulting in the fact that there had been significant changes in several states relating to groundwater quality protection and management.

So even this report is somewhat premature, in that several states are in the process of updating and restructuring their own programs. Any assessment as to the capability of states to manage and protect groundwater resources that was based on data a couple of years ago is outdated, and any assessment that might be drawn today I think will be outdated in another year or two because this is dynamic. It is evolving, and the states are upgrading their capacity to handle this issue.

I hope the report is a useful resource for the Subcommittee and others as they consider this important issue. In the Council's view, the western states are actively engaged in carrying out the responsibility to manage and protect groundwater resources, and national policy should seek to support and enhance those efforts.

Notwithstanding present State capabilities and the number of Federal laws and programs aimed at protecting groundwater resources, there are several sponsors of various Federal groundwater bills which believe that national legislation is required in order to adequately protect the resource. As this and other committees consider proposals, we would submit the following principles for consideration in addition to those I have enumerated.

The first thing is Federal policy should provide the necessary flexibility for the state to develop programs which are appropriate for their own circumstances. The foundation elements include aquifer protection standards or alternative criteria to protect all beneficial uses of groundwater and implementation of strategies and mechanisms appropriate to protect their resource.

Second, the Federal role should be designed to be in support of and in accord with State groundwater protection programs. Any Federal funds provided should be available for development and implementation of State programs, not just a development. To do otherwise is to jeopardize and punish those states who have already developed groundwater programs.

Third, Federal technical assistance should be enhanced under any new legislation. Where some State programs have been less effective than others in achieving groundwater protection goals, the underlying problem has nearly always been lack of technical and financial resources. Any new Federal funding for groundwater efforts should be directed particularly towards providing increased technical support.

Fourth, any new Federal groundwater legislation should seek to insure good neighbor policy, which requires that all Federal agencies conduct their activities which have a potential to affect groundwater quality in accordance with State groundwater protection programs. Federal lands constitute a vast majority of the lands in the west, and many of the critical problems that have been identified so far occur in connection with Federal enclaves. So we think it is important that there be requirements that Federal agencies conduct their activities in accordance with State groundwater strategies.

As you have discussed, Mr. Chairman, EPA has developed and is implementing its groundwater protection strategy. The Council has taken a close look at that strategy. As we see it, the major thrusts are to, one, support primary State administration of State groundwater programs; two, survey unaddressed threats to groundwater quality, three, adopt guidelines for groundwater protection; and four, improve EPA's institutional capability with regard to groundwater. The Council finds those objectives to be sound and is in agreement with them.

The strategy's emphasis upon the inventorying of inadequately addressed sources of groundwater contamination is meritorious. Also, the strategy's emphasis on internal strengthening within EPA of their capacity and coordination is well placed.

The EPA Office of Groundwater should be of great value to EPA's internal operation. With proper focus, the office could assure that internally EPA groundwater-related activities are better coordinated, which is a need, especially in insuring that they are conducted in accordance with and in support of State groundwater quality programs.

On the other hand, the Council has expressed concern regarding the aquifer classification system contained in the EPA strategy. This portion of the strategy could result in effectively transferring from State government to the Federal government determinations as to the levels of treatment required for various waterbearing zones, which is a foundation element of any groundwater protection strategy.

Another difficulty with EPA strategy has been that funds have been available only for State program development and not implementation. Also, the strategy is silent with respect to activities that take place on Federal lands. As I noted previously, because of the vast amount of Federal land that is located in the west, it is important, we believe, that there be Federal directives that require that such activities that have the potential to affect groundwater quality be in compliance with State groundwater programs.

In conclusion, I would like to reiterate that the Western States Water Council has as a high priority working with Congress and others to support Federal and State efforts to encourage and support successful administration of State groundwater quality programs.

Federal programs should be carefully tailored to support the states in their efforts to carry out groundwater quality laws as well as carefully designed to avoid interference with constitutionally protected property rights and groundwater use.

At the same time, the Council has urged each of its member states to examine its groundwater protection program and, where needed, to take all steps necessary to insure that the program is fully effective and protects all national and State interests with respect to groundwater quality within their state.

The most effective groundwater quality protection programs, we believe, will be tailored to meet specific needs which may vary from state to state and which may be different in one area of the country from another. Site and situation-specific management practices are most effective in protecting groundwater quality protection, and State and local governments in turn are best suited to carry out those kinds of practices.

The Council recognizes that these recommendations are based on active, assertive, effective State program efforts. With the Federal Government providing appropriate support, the Council is confident that each of its member states will meet the challenge of providing those essential efforts. That is the objective of this Council, and we hope to continue to work with Congress towards that objective.

Thank you.

[The prepared statement of Mr. Bell follows:]

Testimony

by

The Western States Water Council

regarding

National Ground Water Policy

Submitted to the

Senate Committee on Energy and Natural Resources

Subcommittee on Water & Power

on June 18, 1987

Mr. Chairman and Subcommittee members, my name is Craig Bell. I am the Executive Director of the Western States Water Council. The Council is an organization comprised of representatives appointed by the Governors of fifteen western states. Council members consider a broad range of issues related to the management, protection, and development of water resources in the West. We are therefore grateful for the opportunity to present our views on the subject of national ground water policy. The Council continues to consider its position with regard to this important subject, and further policy statements may be forthcoming with regard to bills pending in Congress. My statement today is based on principles enunciated in previous Council policy positions and a recent Council report on the subject.

As is true throughout the Nation, ground water is a critically important natural resource in the West. While the vast majority of ground water use in the western states is for agricultural purposes, ground water is also an important source of water used in industry, mining, and electric power generation. Further, half the citizens in the West depend on ground water for their municipal needs. In some areas, the figure is much higher. I believe Westerners, by and large, appreciate the significance of ground water and are willing to take the steps necessary to assure that it is of sufficient quality to allow for its continued beneficial use.

Ground water management - the protection of its quality and its allocation for beneficial use - requires careful coordination among all levels of government. Historic federal policies have emphasized the primacy of states in administering ground water allocation and quality protection. Consistent with this policy of deference, the western states have established permitting programs to govern ground water rights and have developed or adopted various legal mechanisms to protect the quality of the ground water within their borders.

The Western States are geographically and economically diverse. Understandably, western state legal institutions for the protection of ground water quality differ. However, it is important to realize that all western states have established such institutions. Some state plans categorize ground waters into classes and establish standards, both discharge and ambient, aimed at protecting each class. Some designate critical ground water recharge areas and formulate regulations aimed at their protection. Regulation of the underground injection of hazardous waste is accomplished in all states either under the federal Underground Injection Control Program or pursuant to state injection control laws. Regional enforcement mechanisms are included in some state ground water protection programs as are public notice and participation practices with regard to permitting activities. Some states are formulating programs to address previously unaddressed sources of ground water contamination.

In addition to state ground water quality programs, virtually all western states have legal schemes to govern ground water allocation. Generally, an application must be made before a well may be drilled. A state administrative official or body will rule on the application based on factors which differ from state to state. Once a permit is issued, the permittee has a legal right, considered a constitutionally protected property interest, to withdraw a certain amount of ground water for beneficial uses.

There is widespread agreement that states should continue to have the exclusive responsibility with regard to the creation and administration of ground water rights. It follows that any proposal for federal ground water legislation must be carefully constructed so as not to interfere with the states' prerogative and ability to manage and protect ground water rights.

With regard to ground water quality, any proposals for federal ground water legislation should recognize that ground water protection is the primary responsibility of the states, and be supportive of the states' role. It would be inappropriate for Congress to enact ground water legislation mandating that state programs meet rigid requirements and criteria which may not be applicable in the West. Any national policy should be built upon individual state strategies and responsibility for ground water use, management and protection.

Western states are carrying out their responsibilities to protect ground water in a number of different ways. Further, a number of states are currently restructuring their programs. The Western States Water Council has recently published a report entitled Western States Ground Water Management, which contains a state-by-state summary of ground water quantity and quality programs for fifteen western states. I will submit with my testimony today a copy of this report so that it may be included as part of the record of this hearing. The report is an update of a similar report which was written in 1982. In one sense, the update is somewhat premature as another revision may be necessary in the near future because of the projected changes in many state ground water programs. In the Council's view, the western states are actively engaged in carrying out their responsibility to manage and protect ground water resources. National policy should seek to support and enhance these efforts.

Notwithstanding present state capabilities and a number of federal laws and programs aimed at protecting ground water resources, the sponsors of various of federal ground water bills believe that their proposals are necessary to adequately protect the Nation's ground water. As this and the other committees and subcommittees of Congress consider such legislation, the following principles should be given consideration in addition to those previously enumerated.

First, any federal policy should provide the necessary flexibility for the states to develop programs appropriate for their own circumstances with foundation elements which include: (1) aquifer protection standards or alternative criteria to protect all beneficial uses of ground water; and (2) implementation of strategies and mechanisms appropriate to assure ground water protection.

Second, the federal role should be designed to be in support of and in accord with state ground water protection programs. Any federal funds provided should be available for development and implementation of state ground water quality programs, not just program development. Otherwise, states that have already developed programs are ineligible for funding.

Third, federal technical assistance should be enhanced under any new legislation. Where some state programs have been less effective than others in achieving ground water protection goals, the underlying problem has nearly always been the lack of technical and financial resources. Any new federal funding for ground water efforts should be directed particularly towards providing increased technical support.

Fourth, any new federal ground water legislation should seek to insure a "good neighbor" policy that requires all federal agencies to conduct their activities which have the potential to affect ground water quality in accordance with state ground water protection programs. Federal lands constitute a majority of all lands within the several western states. In some instances, the most egregious ground water pollution problems which presently exist are directly related to operations at federal enclaves.

As you are aware, EPA has developed and is implementing its "Ground Water Protection Strategy." In general terms, the Council has commended EPA's strategy. The four major thrusts of the strategy are to: (1) support primary state administration of state ground water programs; (2) survey unaddressed threats to ground water quality; (3) adopt guidelines for ground water protection; and (4) improve EPA's institutional capability with regard to ground water. The Council finds these basic objectives to be sound, and is in agreement with them. The strategy's emphasis upon the inventorying of inadequately addressed sources of groundwater contamination, e.g., underground storage tanks, is meritorious. It is a positive and necessary first step in the development of a federally supported state program of prevention and cleanup in this important area. The strategy's emphasis on strengthening EPA's internal ground water organization is also well placed. The new EPA Office of Ground Water should be of great value to EPA's internal operation. With proper focus, the new office could insure that, internally, all EPA ground water related activities are coordinated, especially in insuring that they are conducted in accord with and in support of the dominant, comprehensive groundwater quality program establish by each state.

On the other hand, the Council has expressed concern regarding the aquifer classification system contained in the EPA strategy. This portion of the strategy could result in effectively transferring from state government to the federal government determinations as to the levels of treatment required for various water bearing zones, the foundation element of any ground water protection strategy. Another difficulty with EPA's strategy has been that funds have been available only for state program development and not for state program implementation. Also, the strategy is silent with regard to ground water contamination arising on federal lands. As I noted previously, because of the vast amount of federally owned lands in the western states, those states desire federal directives which will require that activities with the potential to affect ground water quality and which occur on federal land be carried out in accordance with state ground water programs.

I would like to reiterate that the Western States Water Council holds as a high priority the commitment to work with Congress, and others, to encourage efforts at the federal and state levels that support, not undermine, override, or otherwise impair the successful administration of state ground water programs. Federal programs should be carefully tailored to support the states in their efforts to carry out ground water quality laws, as well as carefully designed to avoid interference with constitutionally protected property rights to use ground water.

The Council has urged each of its member states to examine its ground water protection program, and, where needed, to take all steps necessary to insure that the program is fully effective in protecting all national and state interests in ground water quality within the state. The most effective ground water quality protection programs will be tailored to meet specific needs which vary from state to state and which may be different from one area of the country to another. Site and situation specific management practices are most effective in protecting ground water quality. State and local programs are best able to carry out such practices.

The Council recognizes that these recommendations are based on active, assertive, effective state protection efforts. With the federal government providing appropriate support, the Council is confident that each of its member states will meet the challenge of providing these essential efforts. You may be assured that the Council supports that objective.

Senator **Bradley**. Thank you very much, Mr. Bell.

Before we go to Mr. Moore, Senator Wallop, do you have any opening statement or comment you would like to make?

Senator **Wallop**. No, I do not have an opening statement. If I had one, it would very much reflect what we have just heard.

Senator **Bradley**. Then let us move on to Mr. Robert Moore, who is Assistant Deputy Commissioner of the DEP in Connecticut.

Welcome to the Committee.

## STATEMENT OF ROBERT E. MOORE, ASSISTANT DEPUTY COMMISSIONER, CONNECTICUT DEPARTMENT OF ENVIRONMENTAL PROTECTION; ACCOMPANIED BY DR. HUGH THOMAS, DIRECTOR, NATURAL RESOURCES

Mr. **Moore**. Thank you, Mr. Chairman. With me today is Dr. Hugh Thomas. He is the Director of our Natural Resource Center and a Connecticut state geologist. He manages our cooperative programs at USGS.

Connecticut is very familiar with a multitude of threats to our groundwater, the resultant impacts on wells and adjacent water bodies and the need to manage this resource carefully. Over 1,100 wells have become contaminated in Connecticut in the last eight to 10 years. Connecticut is a small, highly industrialized, densely populated state with 33 percent of our population relying on groundwater supplies.

Senator **Bradley**. I cannot understand you, Mr. Moore. Could you speak into the microphone?

Mr. **Moore**. These circumstances have driven our program for groundwater management in a unique way. It is my desire to acquaint you with the many ramifications of our groundwater strategy and the management programs of that strategy and to offer testimony from our experience on the direction for Federal programs.

Our strategy for groundwater protection is based on a partnership between the state and our 169 municipalities. The strategy is supported in part by limited Federal standards development, research and technical assistance. The program ranges from education to best management practices to enforcement.

These State management programs are all maturing and have their own specific resource needs within the state. A great need, however, is to focus Federal groundwater programs away from substances or source management and onto resource protection through development of health and risk-based standards, determination of the fate of chemicals in the groundwater, and a definition of the hydrogeologic system and its groundwater movement.

Fifteen distinct statewide program elements and several regional or local elements make up our management strategy. These programs are now being integrated into a comprehensive State strategy consisting of water quality and quantity and surface and groundwater as one resource system. The following is a brief discussion of those program elements.

Planning efforts are the basis of the strategy and include annual water quality management plans as well as specific water basin plans. Municipal planning and zoning commissions are required to address groundwater protection in their zoning efforts.

Planning relies on several other program elements: monitoring; research; and data management. We maintain an ambient margin network of over 1,200 public water supply wells, a compliance monitoring network at many land disposal sites, and investigation monitoring.

We have undertaken significant research to define Connecticut's hydrogeology as a cooperative effort with the United States Geological Survey. We are currently studying our highly vulnerable high yield and moderate yield aquifers for the basis of a new wellhead and aquifer acquisition and protection program. A study of pesticide use and resultant contamination and a complete inventory of our groundwater resources is also ongoing in cooperation with USGS.

Marketing and research lead to the need for high quality data management. This takes the form in Connecticut of a computerized geographic information system developed in cooperation with the USGS. We develop, maintain and make available inventories and maps of pertinent natural resource information, including well, water quality, geology, soils, land use, zoning and all waste sources.

Information and planning lead to the creation of two types of water quality standards within the state. Drinking water standards establish the standards for potability based on risk assessment and are used as a basis of permit and enforcement actions.

On a broader scale are use standards, called Connecticut's Water Quality Standards and Classification. All the groundwater in the state is classified into one of four standards for use. This system prohibits many common activities from discharging to over 90 percent of our groundwater.

While protection of groundwater is paramount, areas that are most suitable for waste disposal and waste disposal siting based on hydrogeology of the state are also identified by this classification, so we have focused where waste has to be in Connecticut into a very small part of the state. It accounts for less than 0.3 percent of an area of the state that we have said may be suitable for waste activities.

Closely allied with the issues of standards and classifications are the program elements for water use and allocation. State statutes require a permit for any withdrawal greater than 50,000 gallons per day, with such permits key to the impacts on surface and groundwaters. Minimum stream flow standards based on groundwater base flows must also be maintained.

Groundwater protection is dependent on programs of local assistance and education. The Department provides groundwater management manuals and technical documents to municipalities as well as providing direct site specific assistance for the design of aquifer protection programs.

These programs are all needed State efforts in order to adequately prevent contamination of groundwater. They must, however, be accompanied by strong source controls and remediation efforts for our past activities. Source controls are the heart of the second part of the management strategy, with strong programs to address known problems such as landfill septic systems and industrial operations.

Enforcement must be stringent if we are to gain success in groundwater protection. We have developed a system of administrative, civil and criminal penalties to support our clean water and hazardous waste programs.

Certain activities respond most readily to best management practice. Leaking underground storage tanks are regulated with adopted technical standards for monitoring, replacement and new construction. Similar best management practices are being developed or are in place for other substances.

Substances which pose known serious risks are subject to statewide bans. They include septic system additives which contain toxic pollutants, PCBs, certain detergents and certain pesticides.

We have developed and implemented a program of victims compensation in the state. The program provides both temporary and long-term potable water to affected parties utilizing the polluters' resources where possible but based on a State grant and local funding to assure remediation of the affected people.

Local groundwater water management programs form the basis of an effective statewide program. Municipalities and a variety of regional groups are participating in the process of aquifer identification and aquifer protection. The heart of all local controls rests with decisions on land use controls, including planning, zoning, wetlands protection and specific groundwater protection ordinances. This type of regulation has led to some of our towns adopting performance standards and aquifer protection programs.

Limited delegation of certain monitoring, inspection and enforcement programs to health officials has already occurred and needs expansion. These local programs are growing and represent one of the state's major needs in groundwater management.

This is a very brief description of the many elements of our State groundwater program. It is not perfect, as there are many areas needing expansion. The program addresses the needs of groundwater management in Connecticut but probably will not fit the needs of a western state with our distinct differences in hydrogeologic conditions, land use, sources of contamination and water rights, and State and institutional and legal structures.

This brings me to what the Federal role in groundwater protection should be. At present, we have staff members serving on seven different task forces in the EPA, each addressing only a fraction of the groundwater protection needs with little apparent coordination of those efforts. The impact of solid and hazardous materials and waste, pesticides and sewage cannot be managed as independent entities affecting groundwater. The resources as a whole must be managed and the stresses on it regulated within the framework of a resource goal. Groundwater cannot be managed separate from surface water.

The Federal Government should channel its resources into desperately needed efforts for basic aquifer system research and set criteria for health protection. A Federal effort is needed to understand the fate of complex pesticides and chemicals and the tolerance for them in our environment. Field investigation must be conducted on the many diverse hydrogeologic conditions that govern groundwater flow to enable development of specific aquifer protection programs.

Research and development is needed for more effective measurement instruments and methods of analysis for basic data collection programs. National data bases must be coordinated and made more accessible to water resource managers.

In terms of management, it is reasonable for the Federal Government to require that all states establish standards for groundwater, including ambient standards, use standards and standards for special groundwater systems. State-established standards should then be the basis for cleanup efforts undertaken under all State and all Federal law.

To assure the attainment of standards, states will have to perform assessment and monitoring of its groundwater resource. To assure Congress that goals for national groundwater protection are met, the states should develop both management strategy and a protection plan for groundwater. The nature and scope of details of these programs, however, should be left to the states to meet these specific needs.

Connecticut utilizes a wide variety of program options and focuses attention on the resources and pollutants of concern. For example, we do not deal with uranium tailings, and Colorado does not deal with the residue of our tobacco industry.

In summary, I feel that the Federal role in groundwater protection should concentrate its resources on research, aquifer delineation studies and standard setting. It could by legislation require states to have programs, including standards, assessments, monitoring and protection. EPA's oversight role should be limited to review and comment on these programs.

USGS should support the states with basic scientific studies on groundwater flow systems and related issues.

Groundwater protection offers this Congress, I think, a fresh start for a more creative and effective partnership on environmental protection and environmental management. Despite the many, many national programs that are ongoing in EPA, no national goal to manage or to protect groundwater has been adopted. A strategy exists, but nothing has been adopted by Congress to say protect this for whatever purpose.

EPA will never solve the problem of a small shop which throws solvent out the back door. Most states cannot solve that problem. Only municipalities and the local governments are able to deal with that, and only local governments are able to deal with prevention in terms of land use.

I think ultimately most groundwater protection and prevention will rest with those who are making land use decisions in this country. I think the Federal role must reflect this in its development.

Thank you very much.

[The prepared statement of Mr. Moore follows:]

STATE OF CONNECTICUT
DEPARTMENT OF ENVIRONMENTAL PROTECTION

TESTIMONY OF ROBERT E. MOORE, ASSISTANT DEPUTY COMMISSIONER
CONNECTICUT DEPARTMENT OF ENVIRONMENTAL PROTECTION
BEFORE THE UNITED STATES SENATE COMMITTEE
ON ENERGY AND NATURAL RESOURCES - JUNE 18, 1987

Connecticut is familiar with the multitude of threats to our ground water, the resultant impacts on wells and adjacent water bodies and the need to manage this resource carefully. Over 1100 wells have been contaminated in the last ten years. Connecticut is a small (5,000 sq.miles) highly industrialized, densely populated (3,107,000 people) state with 33% of our population relying on ground water supplies. These circumstances have driven our program for ground water management in a unique way. It is my desire to acquaint you with the many ramifications of our ground water strategy and management programs and to offer testimony, from our experience, on direction for federal legislation.

Our strategy for ground water protection is based on a partnership between the state and our 169 municipalities. This strategy is supported in part by limited federal standards development, research and technical assistance. It includes regulatory and non-regulatory tools. The program ranges from education through technical guidance to best management practices, strict permitting actions, product bans and enforcement. These state management programs are all maturing and have their own specific resource needs. A great need, however, is to focus federal ground water programs away from substance or source management on to resource protection through development of health and risk based standards, determination of the fate of chemicals in ground water and definition of the hydrogeologic system and its ground water movement.

Fifteen distinct statewide program elements and seven regional or local elements, many of which involve mutual action, make up our management strategy. These program elements have evolved somewhat independently over the last 20 years, but are now being integrated into a comprehensive state strategy consisting of water quality and quantity, and surface and ground water as one resource system. The following discussion is a description of the program elements:

Planning efforts are the basis of the strategy and include annual water quality management plans as well as specific basin plans in addition to three other long range efforts. Water utilities are required to prepare individual and regional management plans. Municipal planning and zoning commissions are required to address ground water protection in zoning and certain decisions are subject to review by the State Department of Health Services.

Planning relies on several other program elements, Monitoring, Research and Data Management. These are the tools necessary for intelligent management decisions. We maintain an ambient monitoring network of 1200 public water supply wells, compliance monitoring network at many land disposal sites and investigatory monitoring at many suspected sites of ground water contamination. We have undertaken significant research to define CT's hydrogeology as a cooperative effort with the US Geological Survey. We are currently studying our highly vulnerable high and moderate yield stratified drift aquifers for the basis of a new wellhead and aquifer acquisition and

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protection program. A study of pesticide use and resultant contamination and a complete inventory of ground water resources is also on-going.

Monitoring and research lead to a need for high quality data management. This takes the form of a computerized geographic information system developed in cooperation with the U. S. Geological Survey. We develop, maintain and make available complete inventories and maps of pertinent natural resource information including well water quality, geology, soils, land use, zoning, and all waste sources. This system is a powerful decision making tool which allows us to integrate our resource maps and tabular file data.

Information and planning lead to the creation of two types of Water Quality Standards. Drinking water standards establish the standards for potability, based on risk assessment and are used as a basis for permits and enforcement. On a broader scale are use standards called CT's Water Quality Standards and Classification. All the ground waters are mapped, and classified in one of four standards of use. Classifications cover both ground and surface waters. This system is the keystone for siting of land disposal facilities since it provides the highest level of protection to over 90% of our ground water, prohibits many common activities from discharging and is based on sound hydrogeologic factors. While protection of ground water is paramount, areas most suitable for potential waste disposal siting, based on hydrogeology are identified by classification. This system has been adopted after detailed consultation with municipalities and numerous public hearings. Inconsistency of a proposal with the adopted standards is cause for immediate rejection. Protection of ground waters in areas classified as most suited to disposal is offered through permit processes and technology designed to prevent pollution.

Closely allied with the issues of standards and classifications are the program elements for Water Use and Allocation. State statutes require a permit for any withdrawal greater than 50,000 gpd, with such permits keyed to impacts on surface and ground waters. Minimum streamflow standards based on ground water base flows must be maintained. Utilities are regulated with regard to planning, water quality, quantity, rate and service area as part of this program. Cooperative statewide hydrologic data networks and a Water Use Information Program provides an information base on ground water availability and use for various purposes.

Ground water protection is dependent on programs of Local Assistance and Education. The Department provides ground water management manuals and technical documents to municipalities, as well as providing direct, site specific assistance for the design of aquifer protection programs. In conjunction with local officials, we have developed formal program for delegation of certain state authorities such as the ability to inspect facilities to those officials. Educational materials are provided through newsletters and other publications. Our household hazardous waste collection day program, a cooperative state/local funded program includes a formal school curriculum, advertising and literature in addition to the actual collection and disposal.

These programs are all needed state efforts in order to adequately prevent contamination of ground water. They must, however, be accompanied by strong source controls and remediation efforts.

Source controls are the heart of the second part of the management strategy with strong programs to address known problems such as landfills, septic systems and industrial operations. Permitting of new facilities and remedial actions must be consistent with the Water Quality Standards. Uncontrolled sources such as spills are handled by active emergency response teams utilizing a State spill response fund with provision for containment and removal. Well drilling is regulated through permits and construction standards. Enforcement must be stringent if we are to gain success in ground water protection. We have developed a system of administrative, civil and criminal penalties to support our clean water and hazardous waste laws. We have undertaken thousands of enforcement actions related to ground water. The authority for the Department to place a "super lien" on contaminated property program has been recently added as an enforcement tool and has brought lending institutions into our control efforts.

Certain activities respond most readily to Best Management Practices. Leaking underground storage tanks are regulated with adopted technical standards for monitoring, replacement and new construction. Similar management practices are being developed for fertilizer and integrated pest management as well as road salt storage and application. New and re-issued industrial discharge permits require spill prevention plans.

Substances which pose known serious risks are subject to Statewide Bans. These include septic system additives which contain toxic pollutants, PCB's, certain detergents and pesticides.

If our past and current efforts fail and drinking water supplies are contaminated we have developed and implemented a program of Victim Compensation. This program provides both temporary and long-term potable water to affected parties, utilizing the polluters resources where possible but based on state grant and local funding to ensure remediation. To prevent the creation of more victims our property transfer law provides clean-up provisions prior to sale of commercial and industrial land.

Local ground water management programs form the basis for an effective state-wide program. Municipalities and a variety of regional groups are participating in the process of Aquifer Identification and Aquifer Protection with measures such as land acquisition, conservation assessments and controls on development rights and water uses. The heart of all local control rests with decisions on land use controls including planning, zoning, wetlands protection, and specific ground water protection ordinances, all based in state statute and administered by local government. This type of regulation has led to some of our towns adopting Performance standards and Aquifer Protection Programs based on guidance provided by the Department. Limited delegation of certain Monitoring, Inspection, and Enforcement Programs to health officials has already occurred and needs expansion. These local programs are growing and represent one of the states major needs in ground water management.

This is a brief description of the many elements of a state ground water program. It is not perfect, with many areas needing program expansion. We need far more research efforts to assist us in many areas and considerable program development. This program addresses the needs of ground water management in Connecticut but probably would not fit the needs of a western state, where there are distinct differences in hydrogeologic conditions, land use, municipal sources of contamination, water rights and state institutional and legal structures.

This brings me to what the federal role in ground water protection should be. It is perhaps easier to define what it should not be. At present, we have seven staff members serving on different EPA task forces, each addressing only a fraction of ground water protection needs with little apparent coordination of those efforts. The impact of solid and hazardous materials and wastes, pesticides and sewage cannot be managed as independent entities affecting ground water. The resources as a whole must be managed and the stresses on it regulated within the frame work of resource goals. Ground water cannot be managed separate from surface water.

Nationwide efforts by the federal government to create a uniform system of ground water protection programs accompanied by an array of paperwork, and regulations is not workable or needed. Ground water, geology, soil, land use, pollution sources, and ground water utilization vary greatly across this country and effective, tailored state programs must be the goal.

The federal government should channel its resources into the desperately needed efforts for basic aquifer system research, and set criteria for health protection. A federal effort in chemodynamics is needed to understand the fate of complex pesticides and chemicals and the tolerance for them in our environment. Field investigation must be conducted on the many diverse hydrogeologic conditions that govern ground water flow to enable development of specific aquifer protection programs. Research and development is needed for more effective measurement instruments and methods of analysis for basic data collection programs. National data bases must be coordinated and made more accessible to water resource managers. The US Geological Survey should provide states with more technical assistance, basic hydrologic data and aquifer studies through expanded federal/state cooperative programs.

In terms of management, it is reasonable for the federal government to require that all states establish standards for ground water, including ambient standards, use standards and standards for special ground water systems. These standards should reflect the technical information provided by EPA and USGS. State established standards should be the basis for clean-up efforts undertaken under state and all federal law. To assure attainment of standards states will have to perform assessment and monitoring of its ground water resources.

To assure Congress that national goals for ground water protection are met, the states should develop both a management strategy and a protection plan for ground water. However, the nature, scope and details of these programs should be left to the states to meet these specific needs. Federal guidance and review would be appropriate and must recognize the vast differences in hydrogeology and ground water threats which exist throughout the country. Connecticut utilizes a wide variety of program options and focuses its attention on resources and on pollutants of concern, for example we do not deal with uranium tailings and Colorado does not deal with the residue of our tobacco industry.

In summary, we feel that the federal role in ground water protection should concentrate its resources on research, aquifer delineation studies and standards setting. It could, by legislation, require states to have programs including standards, assessments, monitoring and protection. EPA's oversight role should be limited to review and commentary, while the US Geological Survey should support the states with basic scientific studies on ground water flow systems and related issues, and should continue its series of annual National Water Summaries. State surface water management programs differ from state to state and are linked only by requirements for compatible interstate water quality standards and common program elements for monitoring, enforcement, and planning.

Ground water protection offers this Congress a fresh start for a more creative and effective partnership in environmental protection. Give us the tools through research, resource assessment and standards, give us your valuable comments, give us technical support when we ask and we will protect the ground water. As of October 1986, EPA reported that it had 270 programs which addressed 35 principal ground water contaminant sources. Regulatory measures applied to waste management activities was the focus of 217 of these programs. Despite all these program efforts no national goal to manage or protect ground water has been adopted. EPA will never solve the problem of a small shop which throws solvent out the back door and in most cases neither will the state. Only municipalities will solve it, utilizing a state developed regulatory and enforcement program based on a national pool of knowledge. Ultimately much of ground water protection will rest with those making land use decisions. The federal role must reflect this.

Senator **Bradley**. Thank you very much, Mr. Moore, for your testimony.

I think I heard both of you make comments in the course of your testimony about how USGS and EPA could be more helpful and give greater assistance to non-Federal interests, and the question is can you summarize how you think EPA or USGS could be more helpful, each of you in turn?

Mr. **Moore**. For our groundwater protection program, the most important thing we need to know is the effect of chemicals on health and what pesticide in groundwater means. We need to know if we should ban the substance or if we should move to make different control mechanisms, and whether we should provide drinking water.

We are not in the position, resources or otherwise, to develop those health criteria on the thousands and thousands of chemicals that exist in our environment and are in daily use. I cannot do that. I think that is probably the most critical single thing that I need from EPA is the safe level of a substance to drink. That is probably the single most important thing that I need.

In many cases, it is much too late. We have 417 wells in Connecticut contaminated with pesticides and only two pesticides that we have standards for for drinking. I am looking for about another 8 or 10 standards this year, and I am not going to find them.

Mr. **Bell**. I would agree with that statement. I think we need more information about the scope of the problem. We need more data. USGS has an excellent reputation for providing scientific information and collecting data, and if they could enhance their efforts relating to groundwater information and data, I think it would be helpful. Also from EPA, health effects information and standards would be helpful.

I also emphasize that the emphasis so far in the strategy towards coordination among Federal statutes is well placed. It has not been realized in large part. More needs to be done.

I guess the third point I would make is that we would like to see directives to Federal agencies that have activities on Federal lands to the effect that they should comply with State groundwater programs. I think that would be helpful, also.

Senator **Bradley**. Directives from EPA to, say, BLM and the Forest Service; is that what you mean?

Mr. **Bell**. Yes. To the extent that that is possible under existing jurisdiction, I think it would be helpful, at least advice and recommendations that they do so.

Senator **Bradley**. In your testimony on page 4, you said, "In some instances, the most egregious groundwater pollution problems which presently exist are directly related to Federal enclave."

Did you have several in mind when you made that statement? Could you share those with us?

Mr. **Bell**. I am unable to do that today. I would be happy to document that statement, though.

Our members comprise, in part, the heads of State water quality agencies. That is a statement that comes from their experience, and so I am confident that we can document. I would be happy to do so.

Senator **Bradley**. If you could provide for the record as many as they are concerned about, I would like to know where they are.

Mr. **Bell**. I would be happy to do so.

[The information follows:]

WESTERN STATES WATER COUNCIL
[illegible]

July 10, 1987

The Honorable Bill Bradley
United States Senate
Senate Hart Building, Room 731
Washington, D.C. 10510

Dear Senator Bradley:

Enclosed please find a listing of "Ground Water Contamination in the Western States Associated with Federal Lands," which you requested that I provide during the recent hearings on ground water on June 18 before the Subcommittee on Water and Power.

Specifically, you referred to the following statement in my written testimony: "In some instances, the most egregious ground water pollution problems which presently exist are directly related to operations at federal enclaves."

You asked me to give some examples to support this statement. Although I was unable to do so at the time, I said that I would be pleased to provide documentation. I believe the enclosure fills my responsibility in this regard, and hope that it might be beneficial to you and members of the Subcommittee.

I want to thank you again for the opportunity the Council had to testify at the hearing. If we can be further assistance to you and the subcommittee, please let me know.

Sincerely,

Craig Bell

D. Craig Bell
Executive Director

cc: Russ Brown

Enclosure

# GROUND WATER CONTAMINATION IN THE WESTERN STATES ASSOCIATED WITH FEDERAL LANDS

The following list contains some examples of ground water problems associated with federal lands and federal activities in the Western United States. It is offered as an appendix to testimony presented by Craig Bell, Executive Director, Western States Water council, at hearings on national ground water policy held by the Water and Power Subcommittee of the Senate Committee on Energy and Natural Resources, June 18, 1987.

## Arizona

Five federal reservations in Arizona have significant, documented ground water contamination problems. Four of these are in or adjacent to heavily populated areas. One, the Navajo Army Depot, is not located in a densely populated area. Williams and Luke Air Force Bases are in or adjacent to Phoenix. Davis-Monthan Air Base is in Tucson and the Yuma Marine Corps Air Station is in Yuma. The ground water contamination at the sites has occurred as the result of defense-related activities.

## Colorado

The most serious ground water problems in Colorado have to do with federal activities and federal facilities. The most significant one, which is one of the most polluted spots in the Nation, is the Rocky Mountain Arsenal where contamination goes back to nerve gas production during World War II. The state has sued the Department of the Army in federal court over contamination at the site. The suit is pending. From the state's point of view, some progress is being made in cleaning up the site.

Two other sites where serious ground water problems exist are Rocky Flats, where nuclear by-products have caused ground water contamination, and the Martin Marietta site. Rocky Flats is owned by the Department of Energy and managed by Rockwell, International. The United States Air Force owns some land at the Martin Marietta site, although most is owned by Martin Marietta. Virtually all of the company's work is done under government contract in military and space programs.

These three sites encircle the city of Denver. All are within the "five county metro area." The contamination which has occurred is severe.

In addition to sites mentioned, it is likely that operations at Army depots located in Colorado Springs and Pueblo, Colorado, have caused ground water contamination.

## Idaho

Five sites at the Mountain Home Air Force Base have been identified as having either contaminated ground water or as posing serious threats to ground water. The sites are a fire training pit, a former landfill now used as a sewage treatment lagoon, an entomology lab, an existing landfill, and an historic petroleum spill.

Another federal facility in Idaho, the Idaho National Engineering Lab, has significant ground water contamination. The lab is operated by the Department of Energy. The Defense Department also has work being performed there. Monitoring indicates that radioactive waste disposed of in an injection well, and handled at sites around the well, has created a defined plume of contamination below the site. So far, the plume has not migrated off from federal land. However, it may in the future. A major contaminant in the plume has a relatively short half-life and radioactive decay may reduce its radioactivity before it migrates off-site. Some of the other contaminants, however, are longer-lived isotopes.

## Nevada

Preliminary tests indicate that at least two federal sites in Nevada have ground water contamination problems. One, the former Stead Air Force Base (now a private base) is located just north of Reno. The concern is over past disposal practices of cleaning solvents which likely contaminated ground water. The other site is the Fallon Naval Air Station. Initial data from this site indicates problems associated with cleaning solvents and the potential for hydrocarbon contamination.

## North Dakota

Arsenic has been detected in some public drinking water supplies in Lidgerwood, Rutland, and Wyndmere, North Dakota. Ground water sampling in the area indicated varying levels of arsenic, with some unusually high levels found. Records show that arsenic-laced grasshopper bait, provided with federal funds and under cooperative agreements between the state and the U.S. Department of Agriculture, was used heavily in the area in the 1930's. Research performed by the state indicates that ground water contamination from disposed bait could be taking place, but no disposal site has yet been confirmed. A probable point source of contamination, located at a former bait mixing site, will require further investigation.

## Oregon

The Ordinance Army Depot is located near the City of Hermiston, in northern Oregon on the Columbia River. The depot has been a storage area for nerve gases and other chemical weapons and has been used as a neutralization area for some arms. These federal activities have led to demonstrable ground water contamination in the area.

### Utah

Ground water contamination from the storage of solvents in open ponds and leaking drums located at Hill Air Force Base has led to contamination of ground water both on and off from the base. A number of toxic chemicals have been detected in test wells. Also, severe ground water overdraft problems have occurred because of activities at the base. For years, the Air Force refused to obtain ground water permits from the state for pumping on the base.

Ground water contamination has also occurred at the Tooele Army Depot. The major cause is cleaning solvents which have been used by the Army. Significant on-site contamination has been detected, and off-site migration has also occurred. TCE is one of the contaminants most often found in test wells in and around the depot.

### Washington

Many areas in Washington State have ground water contamination problems caused by activities on federal land. For example, in the Tacoma area severe contamination has resulted from activities at Fort Lewis and McCord Air Force Bases. A number of drinking water wells were affected by the contamination. In one instance, a water district that serves 25,000 people had to discontinue operation until a treatment facility could be put on line. Also close to Tacoma is the McNeil Island site, a former federal prison (now leased by the state), which has serious ground water contamination problems.

On Whidbey Island two sites on the Navy Air Station, Ault Field and the Seaplane Base, have been contaminated with solvents. Also, the Navy Base at Bangor is contaminated with TNT and the Navy Undersea Station at Keyport is contaminated with solvents and heavy metals. Other military facilities are also suspected of having caused ground water contamination.

In eastern Washington the Department of Energy's Hanford reservation has 1,000 potential sites with ground water problems and 200-300 sites with known contamination. The reserve covers hundreds of square miles. Ground water at the Department of Agriculture's pesticide lab at Yakima is contaminated with pesticide residue of various types.

WESTERN STATES WATER COUNCIL

220 South 2nd East / Suite 200 / Salt Lake City, Utah 84111 / Phone (801) 521-2800

July 20, 1987

Mr. Russell Brown
Professional Staff
Senate Subcommittee on Water and Power
Senate Dirksen Bldg. Room 306
Washington, D.C. 20510

Dear Russ:

Enclosed please find a copy of a summary of federal facilities in California with ground water contamination problems. This information did not reach our office soon enough to be included with my previous letter. Also the State of California prepared it in a somewhat different format than the enclosure to the previous mailing. Nevertheless, I felt it might be of interest to Senator Bradley.

Please let us know if we can be of further assistance.

Best regards

Craig

D. Craig Bell
Executive Director

Enclosure

## SUMMARY OF GROUND WATER CONTAMINATION
## ON FEDERAL FACILITIES IN CALIFORNIA
## JANUARY 1, 1983 TO MARCH 7, 1986

### Region 2 - San Francisco Bay Region

| | |
|---|---|
| Alameda Naval Air Station, Alameda | Toxics |
| Moffit Naval Air Station, Mountain View | Toxics |
| Travis Air Force Base, Fairfield | Toxics |

### Region 3 - Central Coast Region

| | |
|---|---|
| U.S. Penitentiary, Lompoc | Toxics |
| U.S. Army, Fort Ord | Toxics |
| U.S. Air Force, Vandenberg AFB | Toxics |

### Region 4 - Los Angeles Region

| | |
|---|---|
| Pacific Missile Test Center, Pt. Magu, Ventura Co. | Toxics |
| U.S. Navy Fuel Depot, Van Nuys | Toxics |

### Region 5 - Central Valley Region

| | |
|---|---|
| Mather AFB, Sacramento County | Toxics |
| McClellan AFB, Sacramento County | Toxics |
| LeMoore NAS, Kings County | Toxics |
| Castle AFB, Merced County | Toxics |
| Beale AFB, Yuba County | Toxics |
| Sharpe Army Depot, San Joaquin County | Toxics |
| Sacramento Army Depot, Sacramento County | Toxics |
| USDA, Fresno, Fresno County | Toxics |

### Region 6 - Eastern Sierra Region

| | |
|---|---|
| China Lake Naval Weapons Center, Kern County | Toxics |
| Ft. Irwin National Training Center, San Bernardino County | Toxics |
| Edwards AFB, Kern County | Toxics |
| USMC Logistics Base, San Bernardino County | Toxics |
| George AFB, San Bernardino County | Toxics |

### Region 7 - Colorado River Region

| | |
|---|---|
| USMC Base, Twentynine Palms, San Bernardino County | Toxics |
| USDI, Joshua Tree National Monument, San Bernardino County | Toxics |

### Region 8 - Santa Ana Region

| | |
|---|---|
| U.S. Naval Weapons Center, Orange County | Toxics |
| March AFB | Toxics |
| USMC, Tustin Air Station | Toxics |
| Norton AFB, San Bernardino County | Toxics |

### Region 9 - San Diego Region

| | |
|---|---|
| USMC, Camp Pendleton | Toxics |

Senator **Bradley**. Are you concerned about the problem of agricultural chemicals on the aquifer? At the hearing two weeks ago, we had, I thought, a very interesting and vivid presentation about the level of nitrates in groundwater. It was startling that the concentration of nitrates tracked where the most intense irrigation has been and also where there has been heavy use of agricultural chemicals, which I assume is part of your concern.

Is it only pesticides that you want charted, every kind of pesticide, or are there other things that you think should be charted?

Mr. **Bell**. I think it is primarily pesticides, and I think it is important. Clearly, it is a concern in the west, and I think it underscores the wisdom of states handling this issue just because it is so much a matter of irrigation practices; that is, states are responsible for allocating the resource to agricultural and other uses and encouraging and implementing practices related to use which also affect water quality.

It seems to me that that has to be approached, taking into account the interrelationship between groundwater allocation and groundwater quality protection.

Senator **Bradley**. You came out very strongly for the state's role, and one can clearly see that there are great differences among the states in terms of various problems.

What is your thought if a state is not really meeting its responsibilities on the question of groundwater protection? What then happens?

Mr. **Bell**. That is a fair question. I think that certainly there are national interests which have to be addressed, public health being a basic one that everyone would agree on. To the extent that a state is not fulfilling its responsibility to satisfy public health needs, I think that a Federal role is appropriate.

For the most part, my experience is that to the extent that a state has not been effective or implemented its responsibility, it has been mostly because they do not have sufficient technical and financial resources.

So I think if we looked at a Federal role, it would be to support the states in those areas. That would really help the states do their job more effectively.

Mr. **Moore**. Senator, I think before you can define whether the state is doing its job or not, we have to decide what that job is.

For Connecticut, for example, our protection goals, our statutory goals, are based on protecting groundwater for drinking water use. There may be other valid resource protection needs, more or less stringent, that are valid in certain parts of the country. I think that before you can determine whether the state is meeting a groundwater protection program, we have to make it clear what that groundwater protection program is.

I think that the states obviously will have different levels of programs. I think if you look at our surface water quality programs, they are not the same from state to state. There are certain requirements for zero discharges for attaining the fishable, swimmable waters, but if you go to New Jersey and Connecticut you will find that our water quality standards may have the same letters but they mean very different things.

Senator **Bradley**. What do you mean?

Mr. Moore. For example, I have a Class A and New Jersey has a Class A. They are both high quality waters, but I prohibit all discharges into that, and I use that for water supply. New Jersey has a very high quality water but does not prohibit all discharges. They allow certain things.

So that while they are connected by a uniform process of standards, they are connected by requirements for specific planning programs, they have similar enforcement requirements and penalties, yet they are managed very differently and their resources protected in a very different way. Yet, those programs all seem to work.

Senator Bradley. You say that you decide that nothing can be dumped into the water, and in New Jersey they decided some things can be dumped into the water?

Mr. Moore. Yes.

Senator Bradley. So that the quality judgments are being made differently?

Mr. Moore. Right.

Senator Bradley. Even though both are far below the danger level?

Mr. Moore. Both are well protected for their uses. It is just that there is a difference in philosophy or legislative intent of each state; but the goals are still within the national framework on meeting fishable, swimmable programs.

Senator Bradley. Senator Wallop, did you have any questions? I have some more.

Senator Wallop. I would begin by making the observation that you could not have picked a better panel to demonstrate why one blanket policy will not work in this country; yet both their conclusions from the west and the east are precisely the same.

In comparison to Connecticut, my state of Wyoming has 96 municipalities if you count everything, and 97,900 square miles, not 5,000 square miles. We have fewer than 500,000 people as opposed to their 3 million plus people.

To produce some kind of magic national formula that would accommodate both of those things in terms of protection of quantities and a rigid set of guidelines is simply beyond Congress' reach.

I would make another observation, that these two gentlemen have both demonstrated, and I think probably can substantiate throughout the country, that the states are well advanced of the Federal Government in the implementation of strategies and the formulation of strategy and plans for the protection of groundwater. What they do not have, and what really only the Federal Government can provide them is a vast array of highly technical knowledge that they simply cannot generate on their own, and it would be duplicative anyway. It is one perfect idea that the Federal Government could do cheaper and better.

One of the things that always bothers me is that when we get to hearings like this, we begin to talk of groundwater as though it were something that was manufactured by little men in brown shirts and green hats underneath the surface of the earth and that it has no connection or relevance to surface water.

I think if there is a collection of nitrates, it demonstrates clearly that there is a great relevance to surface water, both in quantity and quality.

The question then becomes how on earth can we get a Federal national policy that would accommodate some parts of Washington State with 120 inches of rainfall and some parts of Nevada with less than a half inch of rainfall, each with groundwater capability. You could put groundwater in the desert. It comes from some other places.

The other thing is that USGS is a good source, I grant you, of technical information about hydrogeologic structures, but it is an infant science. In my state, they have some knowledge of major aquifers, but they really do not have much knowledge of anything else. We have been managing quantities of groundwater for some time. Qualities are a more recent event. Qualities are very difficult for a state such as ours.

So as we go along, I agree with the stated goal that prevention is far simpler than cleanup and far more preferable, and therein I believe the Federal Government has had a role well defined by these two disparate interests and entities. Even, I think, the statement of Mr. Moore about the achievement of New Jersey and Connecticut in achieving fishable, swimmable waters within and under a Federal guideline but with different standards tells us there are areas in which we should tread lightly.

I really do not have a question because my questions have been well answered and in an appropriate fashion by these witnesses.

Senator **Bradley**. I would like to ask one or two more questions, and then we really have to move on.

Mr. Moore, you talked about prevention in terms of land use. My guess is that Mr. Bell would not talk about prevention in terms of land use. Am I correct?

Mr. **Moore**. We are down to 3 million people on 3 million acres, completely incorporated and owned privately. The prevention programs that we have to deal with are very linked to what goes where and who makes that decision. Groundwater divides in drainage areas, most of them less than a square mile in size, and we have to have very tight control over what is placed where in order to do that.

Again, that is not a State prerogative in Connecticut. In Connecticut, it is a local decision. There are State laws that guide that, and they are adding more and more regulatory programs at the State level to manage those land use decisions gearing towards groundwater protection, but I think in Connecticut that is where the bottom line in prevention is going to rest.

Mr. **Bell**. Land use is one appropriate way to address the problem but it really does that that is a matter for local governments.

The problem you mentioned about irrigated agricultural, that in part relates to land use and so can be addressed. It is one strategy. Certainly we would not speak in terms of a Federal role related to land use.

Senator **Bradley**. But you would speak in terms of Federal role on Federal land?

Mr. **Bell**. Oh certainly.

Senator **Bradley**. Related to land use.

Mr. **Bell**. Certainly, in compliance with overall State strategies.

Senator **Bradley**. Okay. Let me thank both of you very much for your testimony today.

Did you want to say anything?

Dr. **Thomas**. Yes. Could I respond to the challenge you threw out in your opening remarks?

Senator **Bradley**. Yes.

Dr. **Thomas**. As Mr. Moore indicated, I had responsibility of managing the USGS cooperative program in Connecticut. We have had a cooperative program of the USGS since 1929. I have been managing it since 1972, and it has been a very successful program. I brought some examples along of the types of products that we have produced, and I will leave them with you.

Senator **Bradley**. Could we have those for the record?

Dr. **Thomas**. Yes. What I want to say relative to your comments in your opening remarks of the first meeting with the EPA and U.S. Geological Survey is that I totally agree with the technical needs that were mentioned.

However, in the comment that you made on the funding, I think you will find, and I can speak for Connecticut and I believe the other states will fall into the same categories, that just in the cooperative program area alone there are now offerings made by the State agencies both in terms of direct funds and direct services which cannot be met by Federal matching funds, and this is beginning to increase this difference.

In my opinion, there is a need for major increased funding in the cooperative line item. I would qualify that, however, that it should not be at the expense of other USGS programs because those other programs are quite related in terms of underpinning many of the cooperative studies.

Senator **Bradley**. Such as?

Dr. **Thomas**. Well, take, for instance, any of the USGS geological or topographic mapping programs. They are directly related to the baseline needs for the hydrogeologic studies; therefore, they cannot be cut back in order to increase the cooperative funds because we would then have a deficiency of those particular efforts.

There are specific research programs that are going on, such as the NAQUA Program, the Hazardous Waste Hydrology Program, et cetera. All supply good scientific research information to underpin those State/Federal cooperative programs. Without the continuation of those funds, we would not be any further advanced by just increasing the cooperative funds.

Senator **Bradley**. So let me ask you. Do you see any lack of cooperation between EPA and USGS?

Dr. **Thomas**. We find in Connecticut no lack of cooperation, particularly again with the USGS through the cooperative program.

I think you will find that there is diversity in the emerging capabilities of either the State geologic surveys or their counterpart in groundwater studies. In some cases you will find that the states are dependent upon the USGS for the basic data collection and for the topical studies.

In other cases such as Connecticut, we have been growing to develop a technical staff, and we complement each other on a regular basis. In still other states, you will find perhaps that those technical staffs have evolved to the point where they can handle a lot of the ongoing programs, but there is a real desperate need for the longer term data collection and basic research that the USGS can supply.

Senator **Bradley**. All right. Thank you, all three, very much.

Our next panel consists of Mr. David Baker, Political Director of Friends of the Earth; Ms. Velma Smith, Director, Groundwater Protection Project, Environmental Policy Institute; and Mr. Erik D. Olson, Counsel, Pollution & Toxic Substances Division, National Wildlife Federation.

Welcome to the Committee, and Mr. Baker, please proceed.

## STATEMENT OF DAVID K. BAKER, POLITICAL DIRECTOR, FRIENDS OF THE EARTH

Mr. **Baker**. I am David Baker, Political Director of Friends of the Earth, the United States affiliate and the founder of an international federation of environmental organizations that now exist in 31 countries. Friends of the Earth sponsors an aggressive campaign of public advocacy and education on a range of environmental issues, including protection of groundwater resources.

I would like to begin by thanking the Chairman and the Subcommittee for the opportunity to air our views on this important issue today. In the interest of time, I will summarize my remarks and ask that they be included in their entirety with the full material.

Senator **Bradley**. Your full testimony will be included in the record.

Mr. **Baker**. In addition, we have conferred in the preparation and delivery of our testimony in order that we are not totally redundant in what we say. With the indulgence of the Chair and the Subcommittee, we would like to switch the order and have Mr. Olson proceed before Ms. Smith.

Senator **Bradley**. By all means. Thank you, also, for doing that.

Mr. **Baker**. Friends of the Earth strongly believes that groundwater protection is one of the last great untouched frontiers of State and Federal activity and environmental pollution. There are many problems with contaminated groundwater across the country; yet, there is much groundwater resource that can still be protected.

Timely Federal action in concert with State planning and implementation can foster the efficient prevention of pollution of this resource before we have to embark on a more costly effort of restoring and cleaning it up.

My testimony today will center on two aspects of groundwater protection: First, the need for comprehensive Federal action to protect this resource; and second, the need for strong public participation and notification provisions in any law.

The basic reasons for providing a fundamental role for the Federal Government are quite simple and based on common sense. First, groundwater does not recognize any State or national boundaries. A control program in one state, no matter how stringent, is worthless if another state which adjoins it pollutes a shared aquifer.

For example, recent groundwater monitoring in Iowa has detected high levels of nitrates in some drinking water wells. Nitrates, which can have serious adverse health effects upon humans, for instance the blue baby syndrome, are heavily used in agriculture for fertilizing. While Iowa itself is a large source of nitrates, some people in Northern Iowa believe that the source of the contamination is actually from South Dakota farmers who use a center pivot irrigation agricultural technique.

Iowa has just signed into law a fairly stringent groundwater protection program but, of course, has no jurisdiction over and little recourse concerning the out-of-state farming practices.

Such conditions as those that allegedly exist in this case can only be solved through consistent uniform practices and the development of a Federal role to adjudicate interstate problems.

Another example is the St. Regis Mohawk Reservation located on the St. Lawrence Seaway in New York State. Testing of private wells there has detected, benzene, trichloroethylene, selenium, arsenic, barium, mercury, chromium, PCBs and a host of other chemicals in the drinking water. On the basis of New York State drinking water standards, people were advised not to drink their water. Potentially responsible parties for the pollution included nearby industries, a mound of Seaway dredge spoil and a Superfund site.

The families with contaminated water had great difficulty finding the funds to pay for alternative sources of drinking water, so finally the Superfund PRP paid for bottle water at 10 of the PCB-contaminated sites.

However the potential of an Indian reservation, often treated as a state under many environmental laws and as a sovereign body under some treaties and other laws, which may be subject to State groundwater standards that was potentially contaminated by sludge from an international waterway indicates the complexity of the groundwater contamination problem and the need for some type of Federal role in adjudicating these issues.

Second, it does not make sense to do research 50 times as states develop individual programs. The Federal Government can do much of this work as it sets national standards and develops programs.

The United States Geological Survey in particular could lend its resources and expertise to this task. Though it does have a mandate to characterize the Nation's water resources, USGS has generally interpreted this mandate fairly narrowly. USGS should broaden its basic monitoring effort beyond quantity issues and emphasize assessment of water quality, particularly in the area of synthetic chemical contamination.

I should not leave the impression that USGS is doing nothing. While there is ample additional room for improvement in the depth and volume of research, USGS has played a valuable role in assessing water quality through its national water summary series. We would also emphasize that USGS has never had a health-based standard setting role and feels that this task is more appropriately handled in other agencies.

The need for action by multiple agencies points toward the need for not only a Federal role but a comprehensive Federal role. Congress would be making a mistake to pass a research bill, a standards bill there and not address a broad range of other issues related to groundwater contamination.

A groundwater report issued last year by the National Research Counsel pointed to the need for a comprehensive law. It concluded that groundwater is not a single resource isolated from others but can only be effectively protected by an integrated program that addresses all components of an environment collectively.

Unlike the point sources covered by the Clean Water Act and the smokestacks covered by the Clean Air Act, the sources of groundwater pollution are diverse and diffuse. They can only be controlled efficiently through a comprehensive Federal program with the states as the primary implementing body.

Many have tried to present the groundwater issue as a conflict between State and national authority. We believe that there need be no conflict but that State and Federal activity must necessarily complement and supplement each other. The NRC report stressed that long-term solutions to groundwater contamination problems cannot be handled efficiently by any level of government on its own. We concur with this assessment.

In addition to the governmental role in protecting our groundwater resources, Friends of the Earth believes there is a role for the public to play in any groundwater program. Public participation will enrich and help assure the success of any governmental program. Public notification of any potential health effects from contamination is an obligation that the government must carry out to protect the public and assure its own credibility.

The public is already playing an unwanted role in the assessment of groundwater problems. As long as we do not have a comprehensive program of governmental groundwater monitoring, we will have to make do with over 100 million human monitoring units that are dependent or use groundwater.

Rather than test tubes and scientific analysis, our current monitoring systems use taste, smell and their health to detect problems. The citizens of Santa Clara, California thought they were blessed with clean, non-polluting new industries. Much to their dismay, industrial solvents in an underground storage tank leaked and contaminated their drinking water. The seriousness of the problem was discovered when a Santa Clara mother noticed an excessive amount of health problems in her community.

At the urging of citizens, the State of California began a health study of the area. After several years, the study found an unusual high level of miscarriages and certain birth defects. The contaminant trichloroethane was discovered in the water supply. After additional studies were made to rule out other factors such as smoking and drinking habits, a connection was found between the amount of cold tap water a pregnant woman drank and the chance of a miscarriage.

Citizens are on the front lines in the groundwater contamination problem, and they are on the front lines all across the country. In South Carolina, a full third of the private water wells sampled by the state show unsafe levels of bacteriological contamination.

In Iowa, State environmental officials have cautioned that as many as half of the state's 800 public water supplies may be contaminated with pesticides and other organic contaminants.

In the Tennessee Valley area, the problems are bacteria, nitrates and petroleum products. From 30 to 70 percent of the wells may be contaminated in some counties.

The public clearly needs relief, but in some areas citizens are taking action. Under the provisions of the Safe Drinking Water Act, a program has been set up to give special protection to sole source aquifers that are the only available source of drinking water for 50 percent or more of the citizens in an area.

In Hawaii, a woman named Hazel Cunningham, an average citizen, became concerned because of detections of pesticides in the aquifer that supplied drinking water to her and others in the Pearl Harbor area. While attending a conference on drinking water problems held by the Environmental Policy Institute, Hazel learned about the public participation and notification provisions of the law. Included in this law is a petition process that allows any citizen to petition EPA for consideration of an aquifer for sole source status.

Hazel wrote a letter to EPA stating her concerns, invested 22 cents in a stamp, and sent in her petition. EPA responded that her petition needed information on water consumption in the area and a map of the area to be covered. A trip to the library yielded the information and a map. Hazel invested in another stamp and sent off the information.

EPA responded that Hazel's petition was complete. They have held hearings and are now seriously considering giving the Pearl Harbor aquifer special status.

The Hazel Cunningham story is illustrative of a number of facts. First, citizens will get involved if they are given the chance. Second, citizens can have an impact when they make the effort. Finally, citizens can add to the performance of government programs. Through the investment of 44 cents and some of her time, Hazel has raised important issues concerning pesticide contamination in her home state. If EPA grants her petition, she will have done much to protect the public health in the State of Hawaii.

The addition of public participation in governmental process of protecting groundwater and public notification is also essential to any program. The Safe Drinking Water Act generally protects citizens by setting standards for treatment of drinking water by public and private utilities. The Act includes provisions that mandate that utilities notify its users and the public as a whole when maximum contaminant levels for toxic substances are exceeded.

While those who are on utility systems are provided with this information, those on public wells supplied by groundwater must generally test for themselves. Through public notification under the Safe Drinking Water Act, the public can protect themselves. They can make informed choices to use bottled water or other alternatives. They can choose to avoid giving their children water with the high lead content but only when given the chance.

A similar system must be developed in any comprehensive groundwater protection program to wide disseminate information to owners of private wells. As Congress gives a further mandate to the USGS and the EPA to do widespread monitoring of groundwater, we must assure that, first, this information is in a form not only usable for scientists and for broad research but also for the public.

Second, we must insure that the results of any monitoring program are relayed to the public directly and through the news media.

Though a clear Congressional mandate exists in the Safe Drinking Water Act for strong public notification provisions, EPA is already failing to follow that mandate in its proposed regulations for notification.

I would like to submit for the record comments on these regulations that were prepared by the Legal Environmental Assistance Foundation in Tallahassee, Florida, another local grass roots group, with the help of the EPA I might add.

Friends of the Earth strongly urges Congress to examine EPA's actions and to place strong public notification and participation language in any bill.

Thank you for your concern about this issue.

[The prepared statement of Mr. Baker follows:]

# STATEMENT OF
# DAVID K. BAKER
# POLITICAL DIRECTOR
# FRIENDS OF THE EARTH

BEFORE THE

SUBCOMMITTEE ON WATER AND POWER
OF THE
COMMITTEE ON ENERGY AND NATURAL RESOURCES
UNITED STATES SENATE

JUNE 18, 1987

I AM DAVID BAKER, POLITICAL DIRECTOR OF FRIENDS OF THE EARTH, THE UNITED STATES AFFILIATE AND FOUNDER OF AN INTERNATIONAL ENVIRONMENTAL FEDERATION WITH ORGANIZATIONS IN 31 COUNTRIES. FRIENDS OF THE EARTH SPONSORS AGGRESSIVE CAMPAIGNS OF PUBLIC ADVOCACY AND EDUCATION ON NUMEROUS ISSUES INCLUDING THE PROTECTION OF OUR GROUNDWATER RESOURCES.

I WOULD LIKE TO BEGIN BY THE THANKING THE CHAIRMAN AND THE SUBCOMMITTEE FOR THE OPPORTUNITY TO TESTIFY BEFORE YOU ON THIS IMPORTANT SUBJECT. FRIENDS OF THE EARTH STRONGLY BELIEVES THAT GROUNDWATER PROTECTION IS ONE OF THE LAST GREAT UNTOUCHED FRONTIERS OF STATE AND FEDERAL ACTIVITY. THERE ARE MANY PROBLEMS WITH CONTAMINATED GROUNDWATER ACROSS THE COUNTRY. YET, THERE IS MUCH WHICH CAN STILL BE PROTECTED. TIMELY FEDERAL ACTION IN CONCERT WITH STATE PLANNING AND IMPLEMENTATION CAN FOSTER THE EFFICIENT PREVENTION OF POLLUTION OF THIS RESOURCE BEFORE WE MUST MOUNT A MORE COSTLY EFFORT TO CLEANUP AND RESTORE IT.

MY TESTIMONY TODAY WILL CENTER ON TWO ASPECTS OF GROUNDWATER PROTECTION. FIRST, THE NEED FOR COMPREHENSIVE FEDERAL ACTION TO

PROTECT THIS RESOURCE, AND SECOND, THE NEED FOR STRONG PUBLIC PARTICIPATION AND NOTIFICATION PROVISIONS IN ANY LAW.

COMPREHENSIVE FEDERAL ROLE

THE BASIC REASONS FOR PROVIDING A FUNDAMENTAL ROLE FOR THE FEDERAL GOVERNMENT ARE QUITE SIMPLE AND BASED ON COMMON SENSE. FIRST, GROUNDWATER DOES NOT RECOGNIZE STATE OR NATIONAL BOUNDARIES. A CONTROL PROGRAM IN ONE STATE, NO MATTER HOW STRINGENT, IS WORTHLESS IF ANOTHER STATE WHICH ADJOINS IT POLLUTES A SHARED AQUIFER. FOR EXAMPLE, RECENT GROUNDWATER MONITORING IN IOWA HAS DETECTED HIGH LEVELS OF HIGH LEVELS OF NITRATES IN SOME DRINKING WATER WELLS. NITRATES, WHICH CAN HAVE SERIOUS AVDVERSE HEALTH AFFECTS ON HUMANS, SUCH AS THE "BLUE-BABY SYNDROME", ARE HEAVILY USED IN AGRICULTURE FOR FERTILIZING. THOUGH IOWA IS ITSELF A LARGE SOURCE OF NITRATES, SOME PEOPLE IN NORTHERN IOWA BELIEVE THAT THE SOURCE OF CONTAMINATION IS ACTUALLY FROM SOUTH DAKOTA FARMERS USING THE "CENTER-PIVOT" IRRIGATION AGRICULTURAL TECHNIQUES.

IOWA HAS JUST SIGNED INTO LAW A FAIRLY STRINGENT GROUNDWATER PROTECTION PROGRAM, BUT OF COURSE HAVE NO JURISDICTION AND LITTLE RECOURSE CONCERNING OUT OF STATE FARMING PRACTICES. SUCH CONDITIONS AS THOSE THAT ALLEGEDLY EXIST IN THIS CASE CAN ONLY BE SOLVED THROUGH CONSISTENT UNIFORM PRACTICES AND THE DEVELOPMENT OF A FEDERAL ROLE TO ADJUDICATE INTERSTATE PROBLEMS.

ANOTHER EXAMPLE IS AT THE ST. REGIS MOHAWK RESERVATION LOCATED ON THE SAINT LAWRENCE SEAWAY IN NEW YORK STATE. TESTING OF PRIVATE WELLS THERE HAS DETECTED BENZENE, TRICHLOROETHYLENE, SELENIUM, ARSENIC, BARIUM, MERCURY, CHROMIUM, PCBS AND HOST OF OTHER CHEMICALS. ON THE BASIS OF NEW YORK STATE DRINKING WATER

STANDARDS, PEOPLE WERE ADVISED NOT TO DRINK THEIR WATER. POTENTIALLY RESPONSIBLE PARTIES FOR THE POLLUTION INCLUDED NEARBY INDUSTRIES, A MOUND OF SEAWAY DREDGE SPOIL AND A SUPERFUND SITE. THE FAMILIES WITH CONTAMINATED WATER HAD GREAT DIFFICULTY FINDING THE FUNDS TO PAY FOR ALTERNATIVE SOURCES OF DRINKING WATER, THOUGH FINALLY THE SUPERFUND PRP PAID FOR BOTTLED WATER AT 10 PCB-CONTAMINATED SITES. HOWEVER, THE POTENTIAL OF AN INDIAN RESERVATION (OFTEN TREATED AS A STATE UNDER MANY ENVIRONMENTAL POLLUTION LAWS, AND AS A SOVEREIGN BODY UNDER SOME TREATIES AND OTHER LAWS), WHICH MAY BE SUBJECT TO STATE GROUNDWATER STANDARDS, THAT WAS POTENTIALLY CONTAMINATED BY SLUDGE FROM AN INTERNATIONAL WATERWAY INDICATES THE COMPLEXITY OF SOME GROUNDWATER CONTAMINATION PROBLEMS.

SECOND, IT DOES NOT MAKE SENSE TO DO THE SAME RESEARCH FIFTY TIMES AS STATES DEVELOP INDIVIDUAL PROGRAMS. THE FEDERAL GOVERNMENT CAN DO MUCH OF THIS WORK ONCE AS IT SETS NATIONAL STANDARDS AND DEVELOPS PROGRAMS.

THE UNITED STATES GEOLOGICAL SURVEY (USGS) IN PARTICULAR COULD LEND ITS RESOURCES AND EXPERTISE TO THIS TASK. THOUGH IT DOES HAVE A MANDATE TO CHARACTERIZE THE NATION'S WATER RESOURCES, USGS HAS GENERALLLY INTERPRETED THIS MANDATE NARROWLY. USGS SHOULD BROADEN ITS BASIC MONITORING EFFORT BEYOND QUANTITY ISSUES AND EMPHASIZE ASSESSMENT OF WATER QUALITY, PARTICULARLY IN THE AREA OF SYNTHETIC CHEMICALS CONTAMINATION.

I SHOULD NOT LEAVE THE IMPRESSION THAT USGS IS DOING NOTHING. WHILE THERE IS AMPLE ADDITIONAL ROOM FOR IMPROVEMENT IN THE DEPTH AND VOLUME OF RESEARCH, USGS HAS PLAYED A VALUABLE ROLE

THROUGH ITS NATIONAL WATER SUMMARY SERIES. WE WOULD ALSO EMPHASIZE THAT USGS HAS NEVER HAD A HEALTH-BASED STANDARD SETTING ROLE AND FEEL THAT THIS TASK IS MORE APPROPRIATELY HANDLED IN OTHER AGENCIES.

THE NEED FOR ACTION BY MULTIPLE AGENCIES POINTS TOWARDS THE NEED FOR NOT ONLY A FEDERAL ROLE, BUT A COMPREHENSIVE FEDERAL ROLE. CONGRESS WOULD BE MAKING A MISTAKE TO PASS A RESEARCH BILL HERE, A STANDARDS BILL THERE AND NOT ADDRESS A BROAD RANGE OF OTHER ISSUES RELATED TO GROUNDWATER CONTAMINATION.

A GROUNDWATER REPORT ISSUED LAST YEAR BY THE NATIONAL RESEARCH COUNCIL POINTED TO THE NEED FOR A COMPREHENSIVE LAW. IT CONCLUDED THAT GROUNDWATER IS "NOT A SINGLE RESOURCE, ISOLATED FROM OTHERS, BUT CAN ONLY BE EFFECTIVELY PROTECTED BY AN INTEGRATED PROGRAM THAT ADDRESSES ALL COMPONENTS OF AN ENVIRONMENT COLLECTIVELY." UNLIKE THE POINT SOURCES COVERED UNDER THE CLEAN WATER ACT AND THE SMOKESTACKS COVERED BY THE CLEAN AIR ACT, THE SOURCES OF GROUNDWATER POLLUTION ARE DIVERSE AND DIFFUSE. THEY CAN ONLY BE CONTROLLED EFFICIENTLY THROUGH A COMPREHENSIVE FEDERAL PROGRAM WITH THE STATES AS A PRIMARY IMPLEMENTING BODY.

MANY HAVE TRIED TO PRESENT THE GROUNDWATER ISSUE AS A CONFLICT BETWEEN STATE AND NATIONAL AUTHORITY. WE BELIEVE THAT THERE NEED BE NO CONFLICT, BUT THAT STATE AND FEDERAL ACTIVITY MUST NECESSARILY COMPLIMENT AND SUPPLEMENT EACH OTHER. THE NRC REPORT STRESSED THAT LONG-TERM SOLUTIONS TO GROUNDWATER CONTAMINATION PROBLEMS COULD NOT BE HANDLED EFFICIENTLY BY ANY LEVEL OF GOVERNMENT ON ITS OWN. WE CONCUR WITH THIS ASSESSMENT.

## PUBLIC PARTICIPATION AND NOTIFICATION

IN ADDITION TO THE GOVERNMENTAL ROLE IN PROTECTING OUR GROUNDWATER RESOURCES, FRIENDS OF THE EARTH BELIEVES THERE IS ROLE FOR THE PUBLIC TO PLAY IN ANY GROUNDWATER PROGRAM. PUBLIC PARTICIPATION WILL ENRICH AND HELP ASSURE THE SUCCESS OF ANY GOVERNMENTAL PROGRAM. PUBLIC NOTIFICATION OF POTENTIAL ADVERSE HEALTH AFFECTS FROM CONTAMINATION IS AN OBLIGATION THAT THE GOVERNMENT MUST CARRY OUT TO PROTECT THE PUBLIC AND ASSURE ITS CREDIBILITY.

THE PUBLIC IS ALREADY PLAYING AN UNWANTED ROLE IN THE ASSESSMENT OF GROUNDWATER PROBLEMS. AS LONG AS WE DO NOT HAVE COMPREHENSIVE PROGRAM OF GOVERNMENTAL GROUNDWATER MONITORING, WE WILL HAVE TO MAKE DO WITH OVER 100 MILLION HUMAN MONITORING UNITS THAT USE OR ARE DEPENDENT UPON GROUNDWATER. RATHER THAN TEST-TUBES AND SCIENTIFIC ANALYSIS, OUR CURRENT MONITORING SYSTEMS USE TASTE, SMELL AND THEIR HEALTH TO DETECT PROBLEMS.

THE CITIZENS OF SANTA CLARA VALLEY, CALIFORNIA THOUGHT THEY WERE BLESSED WITH NEW CLEAN UNPOLLUTING INDUSTRY. MUCH TO THEIR DISMAY, INDUSTRIAL SOLVENTS IN AN UNDERGROUND STORAGE TANK LEAKED AND CONTAMINATED THEIR DRINKING WATER.

THE SERIOUSNESS OF THE PROBLEM WAS DISCOVERED WHEN A SANTA CLARA MOTHER NOTICED AN EXCESSIVE NUMBER OF HEALTH PROBLEMS IN HER COMMUNITY. AT THE URGING OF CITIZENS, THE STATE OF CALIFORNIA BEGAN A HEALTH STUDY OF THE AREA. AFTER SEVERAL YEARS THE STUDY FOUND AN UNUSUALLY HIGH LEVEL OF MISCARRIAGES AND CERTAIN BIRTH DEFECTS. THE CONTAMINANT TRICHLOROETHANE WAS DISCOVERED IN THE WATER SUPPLY.

AFTER ADDITIONAL STUDIES WERE MADE TO RULE OUT OTHER FACTORS

SUCH AS SMOKING AND DRINKING HABITS, A CONNECTION WAS FOUND BETWEEN THE AMOUNT OF COLD TAP WATER A PREGNANT WOMAN DRANK AND THE CHANCES FOR A MISCARRIAGE.

CITIZENS ARE ON THE FRONTLINES OF THE GROUNDWATER CONTAMINATION PROBLEM.

IN SOUTH CAROLINA, A FULL THIRD OF THE PRIVATE WATER WELLS SAMPLED BY THE STATE SHOW UNSAFE LEVELS OF BACTERIOLOGICAL CONTAMINATION.

IN IOWA, STATE ENVIRONMENTAL OFFICIALS HAVE CAUTIONED THAT AS MANY AS HALF OF THE STATE'S 800 PUBLIC WATER SUPPLIES MAY BE CONTAMINATED WITH PESTICIDES AND OTHER ORGANIC CONTAMINANTS.

IN THE TENNESSEE VALLEY AREA THE PROBLEMS ARE BACTERIA, NITRATES AND PETROLEUM PRODUCTS. FROM 30 TO 70 PERCENT OF THE WELLS MAY BE CONTAMINATED IN SOME COUNTIES.

THE PUBLIC CLEARLY NEEDS RELIEF, BUT IN SOME AREAS CITIZENS ARE TAKING ACTION. UNDER THE PROVISIONS OF THE SAFE DRINKING WATER ACT, A PROGRAM HAS BEEN SET-UP TO GIVE SPECIAL PROTECTION TO SOLE-SOURCE AQUIFERS THAT ARE THE ONLY AVAILABLE SOURCE OF DRINKING WATER FOR 50 PERCENT OR MORE OF THE CITIZENS IN AN AREA.

IN HAWAII, A WOMAN NAMED HAZEL CUNNINGHAM, AN AVERAGE CITIZEN, BECAME CONCERNED BECAUSE OF DETECTIONS OF PESTICIDES IN THE AQUIFER THAT SUPPLIED DRINKING WATER TO HER AND OTHERS IN AN AREA AROUND PEARL HARBOR. WHILE ATTENDING A CONFERENCE ON DRINKING WATER PROBLEMS HELD BY THE ENVIRONMENTAL POLICY INSTITUTE, HAZEL LEARNED ABOUT THE PUBLIC PARTICIPATION AND NOTIFICATION PROVISIONS OF THE LAW. INCLUDED IN THIS LAW IS A PETITION PROCESS THAT ALLOWS ANY CITIZEN TO PETITION EPA FOR CONSIDERATION OF AN AQUIFER FOR SOLE-SOURCE STATUS.

HAZEL WROTE A LETTER TO EPA STATING HER CONCERNS, INVESTED 22 CENTS IN A STAMP AND SENT IN HER PETITION. EPA RESPONDED THAT HER PETITION NEEDED INFORMATION ON WATER CONSUMPTION IN THE AREA AND A MAP OF THE AREA TO BE COVERED. A TRIP TO THE LIBRARY YIELDED THE INFORMATION AND A MAP. HAZEL INVESTED IN ANOTHER STAMP AND SENT OFF THE INFORMATION.

EPA RESPONDED THAT HAZEL'S PETITION WAS COMPLETE AND THEY HAVE HELD HEARINGS AND ARE NOW SERIOUSLY CONSIDERING GIVING THE PEARL HARBOR AQUIFER SPECIAL STATUS. THE HAZEL CUNNINGHAM STORY IS ILLUSTRATIVE OF A NUMBER OF FACTS. FIRST, CITIZENS WILL GET INVOLVED IF THEY ARE GIVEN THE CHANCE. SECOND, CITIZENS CAN HAVE AN IMPACT IF THEY MAKE AN EFFORT. FINALLY, CITIZENS CAN ADD TO THE PERFORMANCE OF GOVERNMENT PROGRAMS. THROUGH THE INVESTMENT OF 44 CENTS AND SOME OF HER TIME HAZEL HAS RAISED IMPORTANT ISSUES CONCERNING PESTICIDE CONTAMINATION IN HER HOME STATE. IF EPA GRANTS HER PETITION, SHE WILL HAVE DONE MUCH TO PROTECT PUBLIC HEALTH IN THE STATE OF HAWAII.

IN ADDITION TO PUBLIC PARTICIPATION IN THE GOVERNMENTAL PROCESS OF PROTECTING GROUNDWATER, PUBLIC NOTIFICATION IS ALSO ESSENTIAL TO ANY PROGRAM. THE SAFE DRINKING WATER ACT GENERALLY PROTECTS CITIZENS BY SETTING STANDARDS FOR TREATMENT OF DRINKING WATER BY PUBLIC AND PRIVATES UTILITIES. THE ACT INCLUDES PROVISIONS THAT MANDATE THAT UTILITIES NOTIFY ITS USERS AND THE PUBLIC AS A WHOLE WHEN MAXIMUM CONTAMINANT LEVELS FOR TOXIC SUBSTANCES ARE EXCEEDED.

WHILE THOSE WHO ARE ON UTILITY SYSTEMS ARE PROVIDED WITH THIS INFORMATION, THOSE ON PRIVATE WELLS SUPPLIED BY GROUNDWATER

MUST GENERALLY TEST FOR THEMSELVES. THROUGH PUBLIC NOTIFICATION UNDER THE SAFE DRINKING WATER ACT THE PUBLIC CAN PROTECT THEMSELVES. THEY CAN MAKE INFORMED CHOICES TO USE BOTTLED WATER OR OTHER ALTERNATIVES. THEY CAN CHOOSE TO AVOID GIVING THEIR CHILDREN WATER WITH A HIGH LEAD CONTENT. GIVEN THE CHANCE.

A SIMILAR SYSTEM MUST BE DEVELOPED IN ANY COMPREHENSIVE GROUNDWATER PROTECTION PROGRAM TO WIDELY DISSEMINATE INFORMATION TO OWNERS OF PRIVATE WELLS. AS CONGRESS GIVES A FURTHER MANDATE TO THE USGS AND EPA TO DO WIDESPREAD MONITORING OF GROUNDWATER, WE MUST ASSURE THAT FIRST, THIS INFORMATION IS IN A FORM NOT ONLY USABLE FOR SCIENTISTS AND BROAD RESEARCH, BUT ALSO THE PUBLIC. SECOND, WE MUST INSURE THAT THE RESULTS OF ANY MONITORING PROGRAM ARE RELAYED TO THE PUBLIC DIRECTLY AND THROUGH THE NEWSMEDIA.

THOUGH A CLEAR CONGRESSIONAL MANDATE EXISTS IN THE SAFE DRINKING WATER ACT FOR STRONG PUBLIC NOTIFICATION PROVISIONS, EPA IS ALREADY FAILING TO FOLLOW THAT MANDATE IN ITS PROPOSED REGULATIONS FOR NOTIFICATION. I WOULD LIKE TO SUBMIT FOR THE RECORD COMMENT ON THESE REGULATIONS THAT WAS PREPARED BY THE LEGAL ENVIRONMENTAL ASSISTANCE FOUNDATION IN TALLAHASSE, FLORIDA. FRIENDS OF THE EARTH STRONGLY URGES CONGRESS TO EXAMINE EPA'S ACTIONS AND TO PLACE STRONG PUBLIC NOTIFICATION AND PARTICIPATION LANGUAGE IN ANY BILL. THANK YOU FOR YOUR CONCERN ABOUT THIS ISSUE.

Senator Bradley. Thank you, Mr. Baker.
Mr. Olson.

## STATEMENT OF ERIK D. OLSON, COUNSEL, POLLUTION AND TOXIC SUBSTANCES DIVISION, NATIONAL WILDLIFE FEDERDATION; ACCOMPANIED BY DR. GERALD V. POJE, ENVIRONMENTAL TOXICOLOGIST, POLLUTION AND TOXIC SUBSTANCES DIVISION

Mr. Olson. Thank you, Mr. Chairman. Good morning. I am Erik Olson, counsel for the Pollution and Toxic Substances Program at the National Wildlife Federation. With me is Dr. Gerald V. Poje, who is the Division's Environmental Toxicologist.

The Federation is the Nation's largest citizen conservation organization, with over 4.5 million members and supports nationwide. We thank the Committee for inviting us to testify on the important issue of groundwater and USGS and EPA activities related to groundwater.

Groundwater is one of the Nation's most precious resources. As the Chairman just noted in his opening statement, over half of the drinking water in the United States and a large percentage of the Nation's water used for other domestic agricultural and industrial uses comes from groundwater. It also supplies an average of nearly one-third of the flow in the Nation's surface streams and much of the Nation's other surface water, so that contaminated groundwater can pollute interconnected surface water and affect sensitive aquatic ecosystems.

Unfortunately, as this Subcommittee is aware, our generation is depleting and contaminating this all-important resource. We are shackling our children and grandchildren to a future of paying for our excesses and our economic activities by leaving a legacy of depleted and contaminated groundwater as their inheritance.

Serious groundwater contamination occurs in every state of the Nation, including contamination above safe health levels in many states by synthetic organic chemicals, nitrates, bacteria, viruses, pathogens and other organic and inorganic contaminants.

It is tough to quantify the exact implications to public health of contaminated groundwater, but a recent study by a nationally known EPA scientist found that there were over 34,300 documented cases of illness in the United States during the study period due to consumption of contaminated groundwater. This is based on a review of State public health files. It is not a theoretical calculation.

Because of the approach that was used in the study, it is likely that five to 10 times as many people become acutely ill by drinking polluted groundwater; that is, several hundred thousand individuals during the study period. Those are never reported to the Federal officials.

Undoubtedly, there are many thousands more illnesses and perhaps many deaths caused by consumption of polluted groundwater that are never linked to their source. This is especially the case in chronic diseases such as cancer, which are often very difficult to link to the consumption of the contaminants.

Cancer and birth defect-causing chemicals and even immunosuppressive chemicals, that is those chemicals that weaken the body's defenses against attack by bacteria, viruses and parasites, have been found in the groundwater in virtually every state in which groundwater has been tested intensively.

Groundwater, therefore, is polluted across the country from manmade sources, including hazardous waste dumps, industrial and municipal landfills, hazardous material handling, storage and transfer, underground injection wells, excessive and inappropriate application of fertilizer and pesticides, intensive animal husbandry, leaking storage tanks that are both aboveground and underground, faulty septic systems, road salt storage, and many other uses.

Most of our effort and our dollars at the Federal level so far have gone into cleaning up contamination after the fact. We spent billions of dollars under Superfund and under RCRA cleaning up all the hazardous waste dumps and some underground storage tanks. Of course, these cleanups are critically needed, but what are we doing to prevent contamination today and in the future from abundant sources of groundwater contamination.

A recent EPA report found that at EPA alone there are 270 separate ongoing groundwater-related activities. This existing patchwork is often uncoordinated, poorly managed and grossly underfunded.

I would note just as an aside, I used to work at EPA's general counsel's office, and I would say, contrary to what the administration is now saying, there are very limited resources for most of these important programs. Frankly, I think that if you got those people in a closed room and asked them how adequate the resources are at the State and Federal level, they would tell you there is not enough money there to do the job that needs to be done.

These programs are not protecting the public's health and environment adequately. They have gaping holes and often have been extraordinarily ineffective. For example, while EPA does actively regulate hazardous waste dumps, the OTA has identified at least 32 other important sources of groundwater contamination, most of which EPA regulates either minimally or leaves completely unregulated.

By EPA's own calculation, it has some level of activity for 25 of these sources but no activity at all for at least eight categories of major groundwater contamination sources.

The EPA Groundwater Office's recent report that was issued this year says that there is a high level of regulatory activities for landfills, land application of waste, surface impoundments and waste piles; but if you take a look at the recent EPA study by a different office at EPA which is mandated by Congress, you see a completely different picture.

This other office's report found that the regulation, if any, of these sources was, at best, ineffective. About 90 percent of the 16,416 active landfills they surveyed have no liners at all to protect groundwater, and some 96 percent have absolutely no system to collect the leachate that seeps from the landfills.

More than eight out of 10 landfills fail to even monitor groundwater, and 60 percent place no restrictions on the waste that is accepted. More surprisingly, almost 5,000 landfills were not even inspected once a year. Because of the loopholes in existing laws, thousands of tons of hazardous waste are disposed of in these landfills each year.

Another source that the Groundwater Office at EPA claims there is a high level of regulatory activity for is surface impoundments. There are about 190,000 surface impoundments across the country, ranging from 17,000 agricultural waste surface impoundments that have high concentrations of nitrates, pesticides, herbicides and fertilizers to over 125,000 oil and gas waste impoundments containing high concentrations of chloride, total dissolved solids, barium, sodium, calcium and other components. There are also 16,000 industrial surface impoundments and 24,000 mining waste impoundments.

Seventy-one percent of these impoundments were unlined, and only 1 percent uses synthetic liner; that is, a nonsoil liner. Ninety-nine percent of the impoundments have no leak detection, and 96 percent have no groundwater monitoring, while 73 percent have no restrictions on waste placed in the impoundment. Again, 60 percent of the impoundments are not even inspected annually.

As you can see from these statistics, the record for protection of groundwater is not good. In fact, for other sources it is no better, indeed even worse.

As far as the USGS goes, as the Subcommittee is aware the survey has numerous authorities, albeit generally vague ones, to conduct research on groundwater quality and quantity. The survey is not, however, an agency with expertise or experience in regulating. Unfortunately, while the survey is seeking to make itself more relevant and does do numerous very helpful studies, many times its work is of little value to those who are seeking to solve groundwater problems on the ground.

Legislation recently reported out of the House Committee on Interior and Insular Affairs, H.R. 791, seeks to clarify and broaden groundwater research at USGS. Similar measures have been included in the comprehensive Senate Bill, S. 1105, recently introduced by Senators Burdick and Durenberger and several other cosponsors.

We agree that this research legislation is necessary to improve our knowledge of the groundwater problem; however, it is time for Congress to adopt comprehensive Federal legislation now.

It is becoming increasingly clear that State and local regulation alone cannot adequately protect public health and the environment from groundwater pollution. You need only call back to mind the statistics I just quoted to demonstrate that.

Aquifers polluted by one man's activity often cross local and State boundaries; therefore, this pollution will not respect political boundaries, as Dave Baker has pointed out. States need a Federal gorilla in the closet also to enable them to take on locally important industries.

Although some states have begun to attack groundwater pollution aggressively, and I think Connecticut is one of those states, many have not. Frankly, some states have no plans at all to adopt comprehensive groundwater pollution protection programs.

As an aside again, we have been surveying all the states. We sent out over 300 questionnaires to State and Federal officials, and we found that some states have either refused to respond to us or in fact have come forth and simply said that they have no plans to adopt a comprehensive groundwater protection scheme in their state.

We need to assure that every citizen in the Nation receives at least a baseline minimum protection of his or her health, independent of the place of residence, and that these citizens need to be protected from consuming contaminated groundwater.

The National Groundwater Policy Forum, a blue ribbon panel of government, industry and academic and conservationist representatives has recommended that a national groundwater policy must go far beyond research and coordination of the existing programs. The forum recommended that groundwater must be actively managed, not left to ad hoc decisionmaking, and that contamination should be prevented wherever possible because of the technical difficulties and costs involved in cleaning up.

Although the Nation will spend many billions of dollars under Superfund and other laws to clean up——

Senator **Bradley**. Mr. Olson, if you could wrap it up.

Mr. **Olson**. Okay.

I would just like to summarize very briefly, then, for the Subcommittee the elements of comprehensive Federal legislation that we would like to see. The legislation should emphasize that because cleanup is extremely expensive, prevention must be achieved where possible. Legislation must include a national goal for groundwater protection similar to that under the Clean Water Act. An appropriate goal statement should convey the notion that national groundwater policy and the programs to implement that policy should focus on the resource and not necessarily restrict it to uses.

We envision a program that weds source-by-source controls with the utility of numerical limits. Water quality standards based on human health and environmental considerations should be used only as a backup for the source control program.

While a partnership at local, State and Federal levels is fully appropriate, the Federal Government's role must not be restricted to research, guidance and technical assistance. The principle of uniform national standards and setting a floor for protection has been critical under other environmental statutes and should be incorporated into this bill.

There is no justification for waiting for yet another report before we begin to require protective measures. Our inaction today is creating thousands of Superfund sites for tomorrow. Without preventative action, a legacy of scarce polluted groundwater that may forever be impossible to clean up or use will be our bequest to our heirs.

[The prepared statement of Mr. Olson follows:]

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**STATEMENT OF**
**ERIK D. OLSON**
**COUNSEL, POLLUTION AND TOXIC SUBSTANCES DIVISION**
**NATIONAL WILDLIFE FEDERATION**

**HEARINGS ON GROUNDWATER RELATED PROGRAMS OF THE**
**U.S. GEOLOGICAL SURVEY AND**
**THE ENVIRONMENTAL PROTECTION AGENCY**

**100th CONGRESS, 1st SESSION**

**BEFORE THE**
**SUBCOMMITTEE ON WATER AND POWER**
**OF THE**
**COMMITTEE ON ENERGY AND NATURAL RESOURCES**
**UNITED STATES SENATE**

**JUNE 18, 1987**

Good morning, I am Erik D. Olson, Counsel for the Pollution and Toxic Substances Division at the National Wildlife Federation. I am accompanied this morning by Dr. Gerald V. Poje, the Pollution and Toxic Substances Division's Environmental Toxicologist. The Federation is the nation's largest citizen conservation organization, with over 4.6 million members and supporters nationwide, and with affiliated organizations in 49 states plus Puerto Rico and the Virgin Islands. We thank the Subcommittee for inviting the Federation to testify on the important issue of groundwater, and on the related programs of the U.S. Geological Survey (USGS) and the Environmental Protection Agency (EPA).

Groundwater is one of the nation's most precious resources. It supplies approximately half of the drinking water in the United States and a large percentage of the nation's water used for other domestic, agricultural, and industrial uses. Groundwater also supplies on the average nearly one-third of the flow in the nation's surface streams, and much of the nation's other surface water, so that contaminated groundwater can pollute interconnected surface water and affect sensitive aquatic ecosystems, harming fish and wildlife.

Unfortunately, as the Subcommittee is aware, our generation is depleting and contaminating this all-important resource. We are shackling our children and grandchildren to a future of paying for our excesses and economic activities, by leaving a legacy of depleted and contaminated groundwater as their inheritance.

## I. GROUNDWATER POLLUTION AND PUBLIC HEALTH

Serious groundwater contamination occurs in every state in the nation, including contamination above safe health levels in many states by synthetic organic chemicals, nitrates, bacteria, viruses, and pathogens, and many other organic and inorganic contaminants.

The overall impacts of groundwater pollution upon public health are difficult to establish with precision. However, a recent study[1] by a nationally-known EPA scientist concluded, based on a review of state health department records, that there were _over 34,300 documented cases of illness in the United States_ during the study period (1971-1982) due to consumption of contaminated groundwater. Because of the "hit-or-miss" approach used in developing that study, it is likely that five to ten times as many people become acutely ill by drinking polluted groundwater (_i.e._, several hundred thousand individuals), but are never included in these statistics because the illnesses are not reported to federal authorities.

Undoubtedly, there are many thousands more illnesses, and perhaps many deaths, caused by consumption of polluted groundwater, that were never linked to their source. This is especially the case with chronic diseases such as cancer, which often are very difficult to link to consumption of environmental contaminants, in part due to long latency periods. Preliminary epidemiological studies are just beginning at several sites across the country to determine the full magnitude of the health effects of the dumping of cancer-causing agents, and other toxic chemicals with chronic effects, into our underground water supplies.

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[1] G. Craun, "A Summary of Waterborne Illness Transmitted Through Contaminated Groundwater," _Journal of Environmental Health_, Vol. 38, p. 122 (Nov./Dec. 1985).

Cancer and birth-defect-causing chemicals, and even "immunosuppressive" chemicals that weaken the body's defenses against attack by pathogenic bacteria, viruses, and parasites, have been found in the groundwater in virtually every state in which the groundwater has been tested intensively. These organic and inorganic chemicals can come from numerous unregulated or underregulated sources of groundwater pollution, ranging from unlined industrial pits to leaking storage tanks.

## II. THE EXTENT OF GROUNDWATER POLLUTION

Groundwater is polluted across the country from manmade sources, including hazardous waste dumps, industrial and municipal landfills, hazardous material handling, storage, and transfer, underground injection wells, excessive or inappropriate application of fertilizer and pesticides, intensive animal husbandry, leaking storage tanks above and underground, faulty septic systems, road salt storage and use, and many other sources.

For example, the U.S. Geological Survey, after testing over 120,000 wells across the country, has found that nitrates, contamination often linked to improper fertilizer use or human and animal waste, exceed health levels in some wells in 48 states. In some states, over 20 percent of the wells tested exceed health levels. Similarly, EPA has found that at least 22 pesticides contaminate groundwater in 24 states, and that one in every four wells tested in agricultural areas are contaminated with pesticides.

## III. Current Groundwater Related Activities of the U.S. Geological Survey and the Environmental Protection Agency

### A. EPA Activities

The federal government currently is engaged in a variety of groundwater-related research, regulatory, and other activities. Most of our effort and dollars at the federal level have gone into cleaning up contamination after the fact. We spend billions of dollars under Superfund and the corrective action provisions of the Resource Conservation and Recovery Act (RCRA) cleaning up old leaking hazardous waste dumps and certain underground storage tanks. Of course these cleanups are critically needed, but what are we doing to prevent contamination today and in the future from the abundant sources of groundwater contamination?

A recent EPA report[2], found that at EPA alone there are 270 separate ongoing groundwater-related activities. This existing patchwork of often uncoordinated, poorly managed, and grossly under-funded federal programs, ranges from site-specific technical assistance, to the complex regulatory and permitting schemes for hazardous waste dumps. These programs are not protecting the public's health or the environment adequately; they have many gaping holes, and often have been extraordinarily ineffective at dealing with the groundwater protection problem.

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[2] EPA Office of Groundwater Protection, "EPA Activities Related to Sources of Ground-Water Contamination," (February 1987).

For example, while EPA does actively regulate hazardous waste dumps, the Office of Technology Assessment has identified at least 32 other important sources of groundwater contamination, most of which EPA regulates either minimally or leaves completely unregulated. By EPA's calculation, it has "some level of activity" for 25 of these categories of sources, and no activity for at least eight categories of sources, according to a report by EPA's Office of Groundwater Protection.[3] However, a careful review of the 25 categories of sources purportedly dealt with by EPA, reveals that EPA and state regulations for many sources are virtually nonexistent.

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[3] Id. at 6.

The EPA Groundwater Office's report issued this year states, for example, that there is a "high level" of regulatory activity for landfills, land application of waste, surface impoundments, and waste piles.[4] A recent EPA study by the Solid Waste and Emergency Response Office that was mandated by the Hazardous and Solid Waste Amendments of 1984[5], however, paints a completely different picture.[6] This Solid Waste Office study found that the regulation (if any) of these sources was at best ineffective. Approximately 90 percent of the 16,416 active landfills have no liners to protect the groundwater, and 96 percent have no system to collect the leachate that seeps from the landfill. More than eight out of ten landfills fail even to monitor groundwater, and 60 percent place no restrictions on the waste accepted. More surprisingly, almost 5,000 landfills are not inspected even once a year. Because of loopholes in existing laws, thousands of tons of hazardous waste are disposed of in these landfills.[7]

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[4] Id., Exhibit III-2.

[5] These 1984 amendments overhauled the Resource Conservation and Recovery Act (RCRA). Following the completion of the second phase of this study, EPA is to recommend to Congress changes for facilities receiving waste not classified as "hazardous" under EPA rules; EPA also is required to revise its "criteria" for municipal dumps and other facilities receiving household hazardous waste, and hazardous waste from small-quantity generators. See RCRA §4010.

[6] EPA Office of Solid Waste and Emergency Response, "Subtitle D Study: Phase 1 Report." (October, 1986).

Another source for which the Groundwater Office at EPA claims there is a "high level" of regulatory activity is surface impoundments. The recent EPA Solid Waste Office study, however, finds that there are over 190,000 surface impoundments, including 17,000 agricultural waste surface impoundments ("known to have high concentrations of nitrates, pesticides, herbicides, and fertilizers"), over 125,000 oil and gas waste impoundments (containing "high concentrations of chloride, total dissolved solids, barium, sodium, and calcium"), over 16,000 industrial surface impoundments, and over 24,000 mining waste surface impoundments. Of these, 71 percent are unlined, and only one percent use a plastic or other synthetic (non-soil) liner. Ninety-nine percent of these impoundments have no leak detection systems, 96 percent have no groundwater monitoring programs, and 73 percent have no restrictions on the waste placed in the impoundment. Sixty percent of the impoundments are not even inspected annually.[8]

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[7] Id. at ES-8 to ES-11.

The record for protection of the groundwater is no better, and indeed is often worse, for other sources of contamination. Thus, it is clear that the regulatory mechanisms are inadequate to protect human health and the environment.

## B. USGS Activities

As the Subcommittee is aware, USGS has numerous authorities, albeit general and vague ones, to conduct research on groundwater quality and quantity. The Survey is not, however, an agency with the experience or expertise to regulate. The USGS has conducted numerous useful studies, summarized periodically in the "National Water Summary" series, of the problems facing groundwater. However, the Survey often is extraordinarily careful to maintain its quasi-academic self-image and to avoid involving itself in policy and regulatory disputes. Unfortunately, while the Survey is seeking to make itself more "relevant", many times its work is primarily of theoretical or academic interest, and is of little value to those who are seeking to solve the groundwater problems.

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[8] *Id.* at ES-12 to ES-14.

Legislation introduced in the House and recently reported out of the House Committee on Interior and Insular Affairs, H.R. 791, seeks to clarify and broaden the groundwater research of USGS, and to direct the Survey to be of greater assistance to regulators. Similar measures have been included in the more comprehensive groundwater research bill, S. 1105, recently introduced by Senators Burdick and Durenberger, and several other cosponsors. We agree that research legislation is needed to improve our knowledge of the groundwater problem. However, now is the time for Congress also to adopt comprehensive federal groundwater legislation.

## III. The Need for Federal Legislation

It is becoming increasingly clear that state and local regulation alone cannot adequately protect public health and the environment from groundwater pollution. Aquifers polluted by man's activity often cross local and state boundaries, and therefore this pollution will not respect these political boundaries. States competing to attract or keep industries that may cause groundwater pollution have the incentive to adopt lax groundwater protection rules in the absence of minimum national groundwater protection requirements. States also need a federal "gorilla in the closet" to enable them to take on locally important industries.

The current federal environmental laws contain many gaping holes, failing to deal with major sources of groundwater pollution. Although some states have begun to attack groundwater pollution aggressively, many have not. Some states have no plans to adopt comprehensive groundwater pollution protection programs.

Thus, the existing array of state, territorial, local, and federal laws fails to control groundwater pollution from many sources, and is implemented in an uncoordinated and potentially conflicting manner. Consistent groundwater sampling protocols, monitoring requirements, and data management requirements are needed. Most important, however, we need to assure that every citizen in the nation receives at least a baseline minimum protection of his or her health, independent of their place of residence, from consuming contaminated groundwater.

The National Groundwater Policy Forum (NGPF), a blue-ribbon panel of government, industry, academic, and conservationist representatives chaired by former Governor Bruce Babbitt and vice chaired by NWF President Jay Hair and U.S. Steel (now USX) Chief Executive Officer David Roderick has recommended that a national groundwater policy go far beyond research and coordination of existing programs. The Forum recommended that groundwater "must be actively managed, not left to ad hoc decisionmaking," and "that contamination should be prevented wherever possible because of the technical difficulties and economic costs involved in cleaning up." In addition, the Forum concluded that "degradation of the most valuable aquifers and critical water supplies should be prevented," and "that any national groundwater program must recognize wide variation across the country in the nature, vulnerability, and use of groundwater, as well as the capacity of states and local governments to manage it."[9]

The Forum went on to recommend ten detailed components of an effective groundwater protection program. Similarly, the National Wildlife Federation's Corporate Conservation Council, an organization of high-level corporate officials from some of the largest Fortune 500 firms, has recommended that a national groundwater policy focus on prevention of contamination.[10]

This generation has a responsibility to act as stewards of the nation's groundwater resources, protecting them for use by future generations. Although the nation will spend many billion dollars under Superfund and other laws to clean up, to the extent possible, the problems caused by past activity, very few societal resources are spent on preventing groundwater contamination.

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[9] NGPF, Groundwater: Saving the Unseen Resource, in Groundwater Protection (The Conservation Foundation, 1987), pp. 13-14.

[10] The National Wildlife Federation Corporate Conservation Council, "Statement of Policy and Practices for the Protection of "Ground Water" (1986).

## IV. The Elements of Comprehensive Federal Groundwater Pollution Legislation

We therefore call upon the Congress of the United States to adopt comprehensive groundwater legislation that will protect human health and the environment from significant sources of groundwater pollution. The legislation should emphasize that because groundwater cleanup is extremely expensive and sometimes impossible, prevention of contamination must be achieved where possible.

Federal groundwater legislation must include a national goal for groundwater protection similar to that established under the Clean Water Act for surface waters. Such a goal should reflect the level of protection toward which the nation should strive and should guide both Federal and state policy decisions. It need not be written or stated in such a way that implies that achievement of the goal is immediately achievable. Groundwater protection will be an ongoing process.

An appropriate goal statement should convey the notion that national groundwater policy and the programs to implement that policy should focus on protection of the resource and should not be restricted to protection of "uses".

Nonetheless, an important additional objective which should be included under that overarching goal is one which addresses the availability of safe drinking water. This is an important adjunct to a new groundwater bill primarily because of the narrow scope of the Safe Drinking Water Act. Thus, we also support a goal which addresses the safety of drinking water supplies, both public and private, drawn from groundwater resources.

We envision a program that weds the source-by-source approach of "technological standards"[11] with the utility of numerical limits on contamination of groundwater by particular contaminants. Those responsible for each source of groundwater contamination should be required to do all that is feasible to eliminate or mitigate planned or unplanned releases to groundwater.

Water quality standards, based on human health and environmental considerations, would be used as a "backup" to the source control program; under no circumstances should standards be used to imply an "acceptable" level of pollution. Standards, as employed in this approach, are most important in evaluating the utility of and compliance with technological standards; they are key to triggering of enforcement actions.

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[11] The term "technological standards" is used loosely here and would include general standards of care and best management practices that can be utilized to mitigate or alleviate groundwater pollution.

While a partnership of local, state and Federal levels is fully appropriate and desirable for any groundwater protection scheme, the Federal Government's role must not be restricted to research, guidance and technical assistance. The principle of uniform national standards setting a "floor" for protection has been critical under other environmental statutes and should be incorporated into a national groundwater bill.

The Federal Government must also take an active role in oversight of state programs, and the Federal Government must be obligated to implement or enforce Federal groundwater protection programs in the event that states fail or choose not to do so.

Groundwater classification would be utilized to provide for an additional level of protection for particularly vulnerable or particularly crucial groundwater resources. Imposition of additional controls, over and above those required by technological standards, would be appropriate in designated sensitive or special areas. In no case should classification be used to lessen the stringency of established technological standards.

Federal groundwater legislation should provide for public access to information and active involvement in the development of state and Federal program regulations, permit approvals, and enforcement and oversight activities. A Federal right of action should be included in the statute.

## IV. Conclusion

There is no justification for waiting for yet another report before we begin to require protective measures to prevent groundwater contamination in the first instance. Our inaction today is creating thousands of Superfund sites for tomorrow. As the Subcommittee is aware, without preventive action, a legacy of scarce, polluted groundwater that may forever be impossible to clean up or use, will be our bequest to our heirs. Groundwater contamination is a national problem that must be addressed with preventive action. Research is an important part of the solution, but we cannot afford to wait for yet more evidence to accumulate. We need real, effective, preventive action now, before groundwater contamination becomes a national crisis.

Senator Bradley. Thank you very much, Mr. Olson.

Ms. Smith.

## STATEMENT OF VELMA M. SMITH, DIRECTOR, GROUNDWATER PROTECTION PROJECT, ENVIRONMENTAL POLICY INSTITUTE

Ms. Smith. Thank you, Mr. Chairman and Members of the committee.

My name is Velma Smith. I am with the Environmental Policy Institute. And I also would like to thank you for this opportunity to share our views, and to commend you for your interest in the Nation's groundwater resources.

For the sake of brevity, I will simply concur, rather than elaborate substantially, on my colleague's assessment of the importance of the resources, and their concerns with a considerable threat from a diversity of pollution sources.

EPI also concurs strongly with the National Wildlife Federation's conclusion: We must get on with the job of groundwater protection. To draw a phrase from the report of the National Groundwater Policy Forum, what we need is action now.

It seems to us that the debate on groundwater protection is moving rapidly and rightly toward that consensus. We now appear to be moving on to the next difficult but crucial step in the National groundwater policy debate, seeking consensus on what it is we should attempt to do to prevent groundwater contamination.

In the interest of moving that debate forward, I would like to offer briefly one proposal for a Federal response. The approach we recommend to you today is not novel; it is not esoteric, and though its implementation would involve the application of technical information, it is not of itself technically complex.

Indeed, the approach is perhaps embarrassingly simple. It is based on commonsense, on fairness, and on the need for a direct and effective policy which gets to the roots of our problem.

Perhaps its very simplicity is what has caused it to be overlooked, only temporarily, we hope. We believe that effective groundwater protection will occur only when the Federal Government acts to adopt a National program of source controls, aimed at mitigating and eventually eliminating, discharges of pollutants and toxic chemicals to groundwater.

There must be minimum Federal standards of care, and control technologies, for souces and activities which have the potential to pollute groundwater.

The States, in our view, should be empowered to build on those Federal minimum requirements, and they should be provided a sufficient flexibility to utilize alternative but equally effective means of pollution prevention.

We should not stifle innovation, but we must not tolerate inaction. The States should not be provided with the flexibility to choose not to protect either all or a portion of their groundwater resources; nor should the States be provided with the flexibility to exempt certain sources from the requirement to employ all means reasonably available to prevent groundwater discharges.

I think Dr. Moore earlier talked about that there is no essentially one-size-fits-all program, and I think Senator Wallop agreed with that, and that there is no magic formula.

And we do not see that either, but we do think there is some minimum Federal floor which will allow for a lot of diversity beyond that.

Those principles undoubtedly have a familiar ring. They are borrowed from the legislation which this Congress chose to make its first order of business earlier this year, the Clean Water Act.

A source control approach, like the source control approach of the Clean Water Act, is in our view the most direct approach to pollution abatement.

It provides for equitable treatment of all citizens and all polluting sources, and it guards against economic blackmail by pollution sources.

A workable transformation of the clean water approach to the groundwater protection problem will undoubtedly require some adjustment.

For example, we would suggest that definitions of best practicable and best available technology may be too narrow for what we would envision as necessary in an effective groundwater program.

A total reliance on technological fixes may be inappropriate for many groundwater pollution sources. In the framework of groundwater protection, best technologies must be interpreted broadly to include standards of care and management practices which affect the discharge of pollutants.

Further, the nature of the groundwater problem demands a much greater level of ambition and achievement, in terms of what sources are actually covered. We cannot apply controls only to the easy targets, the large industrial facilities, and expect to make the kind of improvements that are necessary.

With groundwater we will have to address both point and nonpoint sources, and we will have to effect changes in the behavior of polluters who have previously escaped or only been lightly touched by environmental regulation.

Pogo may indeed be right in the case of groundwater: We have met the enemy, and he is us, in this case, all of us. As Eric pointed out, the diversity of contamination sources runs the gamut from the homeowner's malfunctioning septic tank to the byproducts of the Nation's defense system, oil drilling, road deicing, wood preserving, on and on.

The enormity of the challenge, then, might tempt us toward inaction. But if there is any lesson that we've all learned from the superfund experience, surely it is, as you said, Mr. Chairman, the price of pollution must be paid by someone at some point in time.

If we choose to be overwhelmed by the scope of the problem and the number of sources, then the automatic default becomes a clean up program.

As a approach to making this vast universe of sources manageable, however, we would suggest that using the Office of Technology list, from their recent report, as a starting point, and from that, developing categories and subcategories of pollutant sources, based on the nature of the pollutants, the means of using, storing or disposing of the pollutants; the type of Federal regulatory mechanism in use, if any; and the extent to which individual or general permits have been issued and enforced by the States.

Congress could then provide careful direction to EPA to embark on an effort to assess the groundwater contamination control practices and technologies employed or reasonably employable within each category.

The task would be to determine what it is that each category of source—not each individual source, but each category—can reasonably be expected to do.

Our goals of protection must drive us to look for the best that can be accomplished. But our goals will necessarily be tempered by the nature of the question we ask.

We are asking for now simply to seek out the best solutions that are available now. Thus, costs and the limits of knowledge and technology are implicitly recognized and accounted for in such an approach.

We must be careful, however, not to confuse what can reasonably be dong with what is standardly being done. I think a case in point would be storage tanks, and with leaking underground storage tanks, if we looked for the standard level of care widely used in the retail petroleum business we might call for corroding bare steel tanks.

Continuation of that status quo buys us nothing in the way of groundwater protection.

We must be sufficiently ambitious when we look for best available solutions, and we must be open to finding new types of solutions; waste reduction and chemical efficieny measures should surely be included.

As you think about this alternative view that we have presented, we would suggest that you compare it with the other options that have been laid upon the table.

The other options which appear to find more favor currently do not in our view compare favorably.

The first, of course, is the no action alternative, which we consider inappropriate.

But there is also a close variation on that option, which at first glance may sound responsible. The approach keeps the Federal role limited, providing the States with technical assistance, with Federal funding—I'm not quite sure from where—and then leaving the problem to the States.

The question we must ask when we look at such proposals is, how does that differ from the status quo? The States, after all, have had the lead on groundwater protection. A handful have been aggressive and innovative in dealing with the particular sources, but that does not translate into adequate protection for all the citizens across the Nation.

Another option which may be discussed is one which sets up a program with a Federal role restricted to the setting of standards.

We agree that an effective program should incorporate groundwater quality standards. We believe that it is fully appropriate for the Federal Government to set those standards, but we are not convinced that standards alone will get the job done.

Look at our experience with standard setting and data gathering on a chemical-by-chemical basis in either the Safe Drinking Water

Act or FIFRA would indicate that that approach is less than expeditious.

As Dr. Moore again pointed out, we start very much sort of behind the game in the standard setting approach.

And eventually, however, we will have to find some means of translating standards back to sources of contamination. That is why we think we should start with the sources.

In conclusion, Mr. Chairman, we would remind the committee that it has taken a long time to understand that we have a probem that merits action.

Perhaps from the days of an old Ohio Supreme Court decision which declared groundwater mysterious, unknowable, and beyond regulation, our Nation has clung to erroneous notions that groundwater is immune from contamination.

Then we began finding cases of contamination, and we altered our notions only slightly. We concluded that they must be isolated instances.

These so-called isolated instances have now cost us a great deal, not only in terms of cleanup dollars, but also in the loss of public trust.

While we see no sense in deploring what we have not done, we see no sense in delay. It is time for the Federal Government to assert its rightful role in the protection of natural resources which we share with citizens in all States and with future generations.

We urge Congress to set out a range of options, including ones based on these principles, and to act with haste to scrutinize all those options carefully, and then to choose the best, the most effective, and the most expeditious means of protecting the Nation's groundwater.

Again, I thank you for your interest. And I certainly will look forward to working with members of the committee on this issue.

Thank you.

[The prepared statement of Ms. Smith follows:]

# ENVIRONMENTAL POLICY INSTITUTE

**Testimony of**
**Velma M. Smith**
**Director, Groundwater Protection Project**
**Environmental Policy Institute**

before the

**Senate Committee on Energy and Natural Resources**
**Subcommittee on Water and Power**

June 18, 1987

Good morning, Mr. Chairman, Members of the Committee. My name is Velma Smith, Director of the Groundwater Protection Project for the Environmental Policy Institute.

On behalf of the Institute, I thank you for this opportunity to share our views, and I commend your interest in the nation's groundwater resources.

For the sake of brevity, I will simply concur with rather than elaborate substantially on my colleagues' assessment of the importance of the groundwater resource and their concern with the considerable threat from a diversity of pollution sources. Mr. Olson has described for you the value of the resource as well as its questionable status as a drinking water reservoir for millions of Americans. As you contemplate that value and the need to protect those who drink from underground water supplies, I hope that you will also consider the undeniable interconnection of groundwater and surface water.

About a billion gallons of groundwater per day seep into the Atlantic and Pacific Oceans, and some estimates indicate that an average of thirty percent of the flows of the nation's rivers and streams actually comes from groundwater. In many areas, this generally ignored function of groundwater may be of major importance to surface water quality and the living resources of our rivers and streams. For example, the State of Florida has reportedly traced pesticide contamination of surface waters to groundwater leachate, and in Virginia a substantial fish kill has been linked with groundwater pollution via oil drilling.

So again, we respectfully suggest that as the members of this Committee consider and debate an appropriate Federal response, you take care to recognize not only how groundwater pollution affects the health of those who drink from public and private wells but also how it affects aquatic life and other environmental resources.

Given the potential impacts on both human health and the environment, the growing reliance on the groundwater resource and the now apparent vulnerability of underground water sources to contamination, EPI concurs strongly with the National Wildlife Federation's conclusion -- we must get on with the job of groundwater protection. To draw a phrase from the Report of the National Groundwater Policy Forum, what we need is "Action Now."

It seems to us that the debate on groundwater protection is moving rapidly and rightly toward a consensus that national action is required. As you well know, EPA Administrator Lee Thomas has recently joined in the call for Federal legislation, and we now appear to be moving onto the next difficult but crucial step in the national groundwater policy debate; we have reached the stage at which we can begin seeking consensus on what it is we should attempt to do -- in Washington and in the State Capitols -- to prevent groundwater contamination.

In the interests of moving that debate forward, I will concentrate this morning on what we believe would be a constructive and appropriate approach for the Federal government.

The approach we recommend to you today isn't novel; it isn't esoteric; and though its implementation would involve the application of technical information, it is not, of itself, technically complex. Indeed, the approach is perhaps embarrassingly simple. It's based on common sense, on fairness, on the need for a direct and effective policy which gets to the roots of our problem. But perhaps its very simplicity is what has caused it to be overlooked -- only temporarily overlooked we hope.

We believe that effective groundwater protection will occur only when the Federal government acts to adopt a national program of source controls aimed at mitigating and eventually eliminating discharges of pollutants and toxic chemicals to groundwater. There must be minimum Federal standards of care and control technologies for sources and activities which have the potential to pollute groundwater resources.

The states, in our view, should be empowered to build upon those Federal minimum requirements, and they should be provided with sufficient flexibility to utilize alternative but equally effective means of pollution prevention. We should not stifle innovation but we must not tolerate inaction. The states should not be provided with the "flexibility" to choose not to protect either all or a portion of their groundwater resources. Nor should the states be provided with the flexibility to "exempt" certain sources from the requirement to employ all means reasonably available to prevent groundwater discharges.

Those principles undoubtedly have a familiar ring. They're borrowed from the legislation which this Congress chose to make its first order of business earlier this year -- the Clean Water Act.

We believe that the Congress would do well to look carefully to the experience with that law, to select the approaches in that statute that have shown some merit for environmental protection, and, at the same time, to learn from the mistakes that have been made and the difficulties encountered.

As I have already indicated, the first and most important policy approach which we would choose to borrow from the Clean Water Act is its heavy reliance on a national regulatory program which addresses pollutant sources directly.

That approach, which comes to us in the Clean Water Act in the form of technology-based controls on wastewater discharges established and applied uniformly to various categories of facilities nationwide, is one which we believe can work for groundwater protection.

It is the most direct approach to pollution abatement; it provides for equitable treatment of all citizens and all polluting sources; and it guards against economic blackmail by pollution sources.

Undeniably, there have been difficulties in the implementation of technology controls in the Clean Water Act, delays in issuance of the guidelines and disagreements over interpretations of the statute. And, the results could not be characterized as a uniform, resounding success. Nonetheless, we believe that, on the whole, you would find a general agreement that the source control approach which serves as the backbone of that law has been a rational and, overall, relatively effective means of protecting the nation's streams and rivers.

A workable transformation of this approach to the groundwater protection problem will undoubtedly require some adjustments and careful fine-tuning. For example, we would suggest that the definitions of "best practicable" and "best available" technology may be too narrow for what we would envision as necessary in an effective groundwater program. A total reliance on technological fixes may be inappropriate for many groundwater pollution sources. In the framework of groundwater protection, "best technologies" must be interpreted broadly to include standards of care and management practices which affect the discharge of pollutants to groundwater.

Further, the nature of the groundwater problem demands a much greater level of ambition and achievement in terms of what sources are actually covered by source controls. We cannot apply controls only to the easy targets -- the large industrial facilities -- and expect to make the kind of improvements that are necessary to protect this vast but vulnerable resource.

As we know, again from the Clean Water Act, this ambition will not be easily realized. Under that law we have concentrated in enforcement on industrial dischargers over municipal dischargers, and in application we have -- to date -- a dismal record with the discharges which we can't see coming out of a pipe.

With groundwater, we will have to address point and nonpoint sources, and we will have to effect changes in the behavior of "polluters" who have previously escaped or been only lightly touched by environmental regulation. Pogo may indeed be right in the case of groundwater: "We have met the enemy and he is us." In this case, all of us.

The diversity of contamination sources runs the gamut from the homeowner's malfunctioning septic tank to the byproducts of the nation's defense system. Oil-drilling, road-deicing, wood-preserving, farming, mining, chemical storage and just "throwing away" our household trash may affect and degrade usable groundwater resources. The Office of Technology Assessment in its publication entitled Protecting the Nation's Groundwater from Contamination compiles a large list of groundwater sources, and the National Research Council in Ground Water Quality: State and Local Strategies warns that "virtually all human activity" may affect groundwater.

The enormity of the challenge, then, might tempt us toward inaction. But if there is any lesson that we all have learned from the Superfund experience, surely it is that the price of pollution must be paid -- by someone, at some point in time. If we choose to be overwhelmed by the scope of the groundwater problem, then the automatic default becomes a cleanup program of enormous and perhaps endless dimension. Hardly a reasonable option in our view.

So we would suggest using the OTA list as a starting point and from that developing categories and subcategories of pollutant sources based upon several characteristics: the nature of the pollutants; the means of using, storing or disposing of pollutants -- e.g., lagoons or land-spreading; the type of Federal regulatory mechanism in use (if any) -- e.g., individual permits, general permits, or guidance; and the extent to which individual or general permits have been issued and enforced by the states.

From that point, Congress can provide careful direction to EPA to embark upon an effort to assess the groundwater contamination control practices and the technologies employed or reasonably employable within each category. The task would be to determine what it is that each category of source -- not each individual source, but each category -- can reasonably be expected to do to prevent groundwater contamination.

Here we believe our goals of protection must drive us to look for the best that can be accomplished, but our goals will necessarily be tempered by the nature of the question we ask. We are asking, for now, simply to seek out those solutions that are available now. Thus, costs and the limits of knowledge and technology are implicitly recognized and accounted for.

In looking at what is "available," however, we must be careful not to confuse what can reasonably be done with what is standardly being done. For example, if we look at what is available for controlling leaks to groundwater from underground storage tanks, we proceed to look closely at double containment technologies. Those technologies are available. But if we look simply for what the standard level of care is in the retail petroleum business, perhaps the answer we get is a bare steel tank which is likely to be corroding.

Continuation of the status quo in that case (and probably in many others) buys us nothing in the way of groundwater protection, and it becomes obvious that we must be sufficiently ambitious when we direct EPA to look for "best available" solutions. In addition, we must be open to finding new types of solutions -- waste reduction and chemical efficiency measures should clearly fall into the scope of what we consider "best available" control technologies.

Again, we note that our proposal to implement a basic source control approach -- of which we have some considerable foundation already in place to address hazardous waste landfills, underground storage tanks and a handful of other sources -- is not an original one. But, with few exceptions, the potential application of this approach to groundwater has not received the serious attention that we believe it deserves.

The other options, which appear to find more favor currently within the Congress and within the Administration, do not, in our view, compare favorably with this one.

The first alternative, of course, is the no action alternative.Obviously, we consider that option as simply irrational at this point.

But there is also a close variation on that option that, at first glance, may sound "responsible." We ask that you take a closer look at the notion of keeping the Federal role limited --

providing the states with technical assistance and Federal funding and then leaving the problem to the states. The basic question we must ask when we look at such proposals is how that differs from the status quo. The states, afterall, have had the lead on groundwater protection. A handful have been aggressive and innovative in dealing with particular sources, but that does not translate into adequate protections for all the citizens of across the nation.

Another option which may be discussed is one which sets up a program with a Federal role restricted to the setting of groundwater quality standards (or in the weaker version, Federal criteria that may or may not translate into state standards). We agree that an effective program should incorporate groundwater quality standards, and we believe that it is fully appropriate for the Federal government to set those standards.

Under the Clean Water Act, we see that source controls are wedded to numerical water quality standards. With this second prong of protection, additional pollution reduction may be required where numerical water quality standards are exceeded, despite the application of minimum control technologies. Thus, standards are used not in a context which condones needless contamination up to certain selected levels, but as a backstop against discharges which will cause harm to the environment.

A similar approach would be appropriate with groundwater, but we believe that standard-setting alone would not be a sufficient means of attacking the problem. A look at our experience with standard-setting and data-gathering on a chemical-by-chemical basis in either the Safe Drinking Water Act or the Federal Insecticide, Fungicide and Rodenticide Act indicates that approach is less than expeditious.

While there is clearly a large universe of groundwater pollution sources, there is probably an equally large or at least difficult universe of contaminants that would demand attention. The OTA study which I referenced earlier lists several hundred contaminants which have been found in groundwater, and from their tabulation, you will see that the extent of our knowledge on health effects alone is not impressive. In any effective standard setting program, both health effects and environmental effects would have to be assessed. And, eventually, means of linking those standards back to the sources of contamination would be necessary.

If we were permitted to speculate on what results might have been achieved had Congress in 1972 decided only to use numerical water quality standards for surface water discharges, we would predict far less pollutant reduction than has been achieved to date. It is likely that we would be fully embroiled in and stymied by debates on specific wasteload allocations, existing levels of water quality, calibration of computer models and the like. Debates and disagreements on those topics continue, but at least they have not been allowed to function as an impenetrable barrier to all progress.

In conclusion, Mr. Chairman, we would remind the Committee that it has taken a long time to understand that we have a problem that merits some action. Perhaps from the days of the Ohio Supreme Court decisions which declared groundwater mysterious, unknowable and beyond regulation, our nation has clung to erroneous notions that groundwater is immune from contamination. When we began finding cases of contamination, we altered our notions only slightly and concluded that they must be isolated instances. These so-called isolated instances have now costs us a great deal not only in terms of cleanup dollars but also in lost public trust.

While we see no sense now in deploring what we haven't done, we also see no sense in delay. It is time for the Federal government to assert its rightful role in the protection of the natural resources which we share -- with citizens in all states and with future generations. We urge Congress to set out a range of options for action, including ones based on the principles of the Clean Water Act, and to act with haste to scrutinize those options and then to choose the best and the most effective and expeditious means of protecting the nation's groundwater.

We commend you, Mr. Chairman, for your interest in this important issue and for creating this forum in which to review the scope of the groundwater problem and the options for response. The Environmental Policy Institute looks forward to working with you and the members of this Committee on the groundwater issue, and I would be happy to try to answer any questions you may have.

Senator BRADLEY. Thank you very much, Ms. Smith and Mr. Olson and Mr. Baker for your testimony.

I have just a few questions.

Mr. Olson, in your testimony on page 8 you refer to, because of loopholes in existing laws, thousands of tons of hazardous waste are disposed of in these landfills.

Could you enumerate what some of those loopholes are?

Mr. OLSON. Well, the two major loopholes in RCRA are for small quantity generators, and those are being hopefully tightened up as time goes by, and there are also loopholes for household hazardous waste; again, it is linked to the size of the generator.

A lot of the waste that you and I generate from under the kitchen sink ends up in the landfill. If an industry had generated more of the same waste, it would have been considered hazardous and had to go to a subtitle C landfill.

Senator BRADLEY. So you are saying that the loophole applies to small generators, and to homeowners.

Mr. OLSON. Right.

Senator BRADLEY. And under the sink? You mean the garbage can?

Mr. OLSON. No, I am just talking about all the chemicals ranging from household pesticides and paint thinners and so forth. Those kind of things, if you add them up on the National level, add up to thousands of tons.

And it is also the small business generators as well.

Senator BRADLEY. You then in the next paragraph go on to detail the size of the problem, in which you say that a recent EPA solid waste office study finds that there are 190,000 surface impoundments—190,000 surface impoundments.

Now are you suggesting that it is your view that all of them should be regulated by EPA?

Mr. OLSON. What I am suggesting is that right now most of these are obviously going unregulated, and a lot of them end up on the National priorities list.

In New Jersey alone, there about a hundred sites, several of which are surface impoundments.

So although I am not suggesting that EPA would have the ability to permit 190,000 surface empoundments, there clearly are certain minimum standards that could apply to surface impoundments that hold certain types of waste.

And clearly, there would have to be some sort of joint, Federal, State and local regulatory program, perhaps, with standards being set at the Federal level, and most of the implementation being done by the States.

Senator BRADLEY. By State and local officials; is that right?

Mr. OLSON. Yes, I would say it would have to depend, obviously, on the size of the impoundment, and the type of wastes that are being handled by the impoundment.

Senator BRADLEY. Because if you just list all of the superfund sites that we have identified now, that number is what?

Mr. OLSON. Well, there are about 900 on the NPL, and there are about 30,000 potential sites.

Senator BRADLEY. And then to jump to 190,000, it is a sizeable jump.

Mr. Olson. Yes, the basic problem is, that as you can see from the statistics, virtually nothing is being done in most places about it.

And hopefully, if EPA were to get in the game, some sort of National standards could be adopted.

Senator Bradley. You mentioned in your testimony that you had conducted a survey of State officials. Could you provide that survey to the committee?

Mr. Olson. What we are doing is, we are going to be coming up with a very large detailed report, which is going to detail on a State-by-State basis, the degree of contamination in each State, and also the current State programs.

And that probably will not be ready for about another four to six weeks. But I would be happy to provide it to the committee when it is.

Senator Bradley. I think it would be very helpful. It shows if there is a gap.

And then Ms. Smith in your testimony you said on page 4, there must be Federal standards of care and control, technologies for sources and activities which have the potential to pollute groundwater resources.

When you say, for sources and activities, do you mean by that, land use?

Ms. Smith. I mean by that the various activities in terms of nonpoint—I mean farming practices, land spreading of sludges.

So things that would not be considered facilities, necessarily, but activities which I guess you might characterize as land use.

I think on a point of land use, in terms of know there is a great fear of the Federal Government intruding into land use issues. My own State of Virginia, there is a great fear of even the local government intruding into land use issues.

But when we look at land use issues, and it seems that in this debate, there are sort of two prongs to land use controls. There is where something happens; land use controls that tell you you cannot do this or that here or there; but there is also, generally, in subdivision plat ordinance, there is how you can conduct activities.

And what we are focusing on with the source controls is taking a look at all of those activities with some potential for pollution, and really having EPA put their resources into what can they do, in how they conduct their activities; what should they be doing in how they conduct their activities.

Not so much as an aggressive role of the Federal Government in where, although when it comes down to a case-by-case level the State may have to make some tough decisions about where as well.

Senator Bradley. And on the question of how, that leads to your recommendation that you begin with the OTA list, and then develop categories and subcategories of pollutant sources based on several characteristics.

Then you lay that out.

Ms. Smith. Yes, sir. I think, Senator, that that relates to the proper question that you asked before in sort of trying to ponder the imponderable in terms of the whole numbers of sources, and are we going to have minions of EPA permit writers and enforcers.

And I do not think that we envision that. But what we can do, if we make the approprirate categorizations, you can look at the kind of practices that occur, find where they have a common thread, a commond thread of either something that has the potential to pollute groundwater, or a common thread of some way you can prevent the pollution of groundwater.

And then have some general control technologies, minimum control technologies, or standards of care required.

Congress has already done that. It is not a new idea. It has been done with the Clean Water Act. It has been done under RCRA for the underground storage tanks.

Basically what we are saying is, take that same framework and apply it to the whole list.

Mr. BAKER. And I think it is important to point out that the things that we are talking about are, in many cases, relatively simple.

When I talk about groundwater protection as a frontier, it is not like we are really out there trying to find the last marginal five or ten percent. Different programs, like for instance the nonpoint source pollution program, often now when you see highway construction, you will see that they put a plastic barrier along the base to catch runoff as it comes along, and catch dissolved particles and also other soils.

These types of activities, buffers on farms, putting a strip of grass between the field and any nearby creek, are actually fairly simple things to do.

One of the advantages that we have in developing a groundwater program is that we are really not talking about coming up in a lot of cases with fairly difficult things. We are talking about simple things that are commonsense that should be done.

Senator BRADLEY. You talk, Mr. Olson, about protecting the resource rather than protection of uses. What does that mean?

Mr. OLSON. Well, the reason I mentioned that is because some of the EPA strategies focus exclusively on current uses. EPA's groundwater protection strategy would look at the current drinking water uses of an acquifer.

And if an acquifer might be used in the future, and is not current used, it could be treated different under some schemes.

And our point is that we ought to look at the resource as a whole, and we ought to look at protecting the resource as a whole, because groundwater contamination sticks around for decades or even hundreds of years, and it does not make sense to just focus in on whose using it today, because it is virtually impossible to predict who will be using it in the future.

Senator BRADLEY. On page 11 of your statement, you say, some States have begun to attack groundwater aggressively; many have not.

Give me three who have done it well, and three who have not.

Mr. OLSON. Okay. Based on our survey, some of the States that are being more activist are Connecticut, New Jersey, and Wisconsin; also Iowa has been pretty active.

Some of the ones that have not include Alabama, Louisiana, Georgia; those are the three that I would include that are not.

Senator BRADLEY. Senator Wallop?

Senator **Wallop**. Thank you, Mr. Chairman.

Ms. Smith, I guess I would begin with one curiosity, and that is, your aside, where in the world is EPA going to find money to provide technical advice. If they have not got money to provide technical advice, how in the world are they going to have money to do what you suggest they do?

Ms. **Smith**. Well, I think that is certainly an appropriate question. And I think it is one that Congress, in trying to craft a proposal, has to look at very carefully.

I think we have to look at things like what just happened in the Iowa legislature, looking at everybody putting in their share, and there, they have a levy on household toxic chemicals; some pesticide levies; a variety of different sources; potentially, tipping fees on solid waste.

I think that also we have to try to take the good from the Clean Water Act, and we have to try to learn what we can do more efficiently.

And if we can find means of working some of these programs more efficiently, I think frankly that empowering citizens with Federal right of action, for pressing for adherence for regulations would in fact cut down on the need for enforcement officials.

So I think that we can be creative, but it is not going to be easy.

Senator **Wallop**. Let me suggest, Mr. Baker, that you well oversimplify some of the things that you are talking about. It is, to be sure, not a very difficult thing to leave a little grass at the end of a field before it goes into drainage.

But you and I both know that that is essentially irrelevant to any groundwater contamination caused by percolation.

Mr. **Baker**. Well, I think it is relevant to the specific question that we were addressing, about best management practices.

Senator **Wallop**. Well, I think it is an oversimplification. There are many simple things, most of which will not be useful.

Mr. **Baker**. Well I would agree that that is only a small aspect, and one of the simpler aspects of what is quite a difficult problem, quite complex; and in many cases, particularly with the effects of some of these chemicals, trying to figure out exactly how they travel in the groundwater hydrogeologic effects, there is a lot of work to be done, and a lot of things we will not be able to find out.

Senator **Wallop**. Well, there is sort of a common suggestion through all of your testimony, at least as I read it, that drinking water standards would be applied to ambient groundwater.

I think one of you suggested that there should be no acceptable level of contaminant. What happens when you have natural levels of contaminant in groundwater?

Are we as a Federal Government going to prohibit people from using that water? I mean, I can show you places in Wyoming where groundwater is pretty impressive, and no one is near it.

Ms. **Smith**. Well, I will try to respond if I can. I think that that is an appropriate question that comes up in every debate about groundwater pollution, is, what are you going to do about existing contamination?. And what about this idea of no level of pollution?

I think in regard to no level of pollution, I think what we are saying is that we should be striving for, we should have a goal, of trying to reach that.

But in selection the source by source approach, and by looking at what things are feasible today, and then how we can essentially press our knowledge to do better, what we are saying is that various activities will go on doing the best that we can do.

If we sit down and take a close look at each type of sources, each category of source, we will have a sense of where the easy ones are and where the tough ones are.

We probably have some of that sense already just from the Clean Water Act and the pesticide application.

Senator **WALLOP**. But it is not so easy as you make it out, and I think you are all oversimplifying this thing. Source control means one thing substantially different in a heavy clay nonpercolating soil than it does in our essentially alluvial areas where I ranch, for example.

I mean, it is just not possible to say, well, we will toss out a standard and the country will follow it, and have it be either logical or fair.

Ms. **SMITH**. I think, Senator, this may be perhaps where we disagree. Some people feel that a valid regional difference allows for using soil or groundwater as a disposal means.

Basically, what we are saying is, we should be striving not to do that; and that in order to move along in not doing that, we should take a case-by-case look at categories of sources.

There will be some categories of sources that will be easy fixes. There is at least one State that still allows annular injection of waste material through injection wells.

There is one State that allows their brine to be disposed of, using it for deicing of their roadways, their brine waste.

I know of another State that allows blasting for putting in septic tanks.

So there are some easy things, and some egregious sorts of practices that could be gotten rid of at a first round touch. But then after that, we will get to some tough ones.

And perhaps some of the extractive industries will be some of the tough ones, about how can they carry on their business and do less damage to the groundwater.

And on those tough ones, we are going to have to take a real close look at what we can accomplish and what we cannot accomplish today.

Senator **WALLOP**. I have two further questions, Mr. Chairman. This concept of nondegradation. But if nondegradation does not mean no discharge, I guess I would have to ask you what does it mean?

Does it not really mean that that standard would say, we cannot continue to utilize septic tanks or fertilizers, or conduct activities such as mining and forestry?

Mr. **OLSON**. I would like to respond to that. I do not know where you are hearing nondegradation. What we had suggested was a goal for the statute that was akin to the goal in the Clean Water Act.

And what that goal is to try to protect the integrity of groundwater as much as we possibly can.

Senator **WALLOP**. Well, the Clean Water Act, with all due respect, was to enhance the quality of water.

Mr. OLSON. That is correct.

Senator WALLOP. So it was not nondegradation, but regradation, if you will.

Mr. OLSON. Yes, and there is also in the Clean Water Bill an anti-degradation requirement that the States have to adopt.

Senator WALLOP. That is where I get the theme that I say runs through this.

Mr. OLSON. Well, the suggestion is that we ought to do as much as we can. Certainly as a goal we feel that we ought to establish something that we are going to be shooting for.

As Velma mentioned, there are going to be some tough nuts that we are going to have to crack. Some extractive industries, for example, may not be able to conduct their business activities unless they degrade the groundwater to a certain extent.

Our hope is that in this dialogue we can bring forth those industries that tell us that they cannot do what they have to do without polluting the groundwater beyond health levels; and maybe during that debate, Congress can make its own decision as to whether those activities should continue unabated.

Senator WALLOP. Well, if that is the case, anybody with any experience in groundwater knows that quantity and quality are so closely interrelated that you cannot really contemplate one without the other.

Now, does this not really mean, in your call, that a strong Federal managerial role for quality is a de facto call for a Federal takeover of the historic State rights of allocation decision, or can you do one without the other?

Mr. OLSON. No, I do not think you have to. Certainly, as a goal, it is important to try to protect both the quantity and the quality of the groundwater.

We are not suggesting have Federal officials in Washington decide how much groundwater a farmer can use in Wyoming.

Senator WALLOP. Well, with all respect, that has been the result of the Clean Water Act and 404 and a whole lot of other things.

It has indeed been; my State is more familiar with that than most. Being a late bloomer, we have been responsible for water quality decisions well downstream that in effect have resulted in Federal takings of water quantity.

And this is going to be precisely the same thing. It has to be if the role that you call for the Federal Government to undertake is implemented, it has to be the same thing.

Whatever you say now and whatever your intent now is, the reality of it will be that that is going to have to be the only way you can do it, because you cannot separate the issues of underground water quality from quantity.

Mr. OLSON. Well, I would suggest, all we are asking for is a Federal baseline minimum to protect public health and the environment.

Now, if in order to do that, the State has to decide to control how the water is used in that area, that may be the result. I am not suggesting that the Federal officials make the calls on how much groundwater can be used.

But if the State decides in its strategy that that is how it wants to make its decisions——

Senator **Wallop**. But the State will be forced into its strategy by the Federal Government, the strong managerial role which you say EPA should be vested with, which contrasts with the advice of Dr. Moore and the Western States water, in which they called for the Federal role to be one of technical assistance and coordination, and you are calling for it to be a strong managerial role.

The consequences of your call is that you will direct through that call the State's quantification strategy.

Ms. **Smith**. Senator, if I could just very briefly, I think what we are calling on the States to do is to follow the Federal lead on protecting the quality of the groundwater resources.

But we are not intruding, and it is not our intention to intrude or have the Federal Government be telling the States what to do with the quantity.

If they choose to use up all their good groundwater, that is their choice.

Senator **Wallop**. Well, we disagree because I think we have had different experiences in life. And I do not intend to carry on an argument here.

But in point of fact, a directed quality strategy from Washington will not leave States options in quantity.

Thank you.

Senator **Bradley**. Senator Murkowski?

Senator **Murkowski**. Mr. Chairman, I have no further questions.

Senator **Bradley**. I would like to thank the panel very much for your testimony. It was very helpful.

And now we will call panel three, Ms. Judy Campbell-Bird, Environmental and Energy Study Institute; and Mr. Martin Jaffe, Associate Professor of the University of Illinois at Chicago on behalf of the American Planning Association.

Welcome to the committee, and if you could limit your testimony to, say, eight minutes or ten minutes, it would be helpful. And then we will go to questions.

Ms. Campbell-Bird.

## STATEMENT OF JUDY CAMPBELL-BIRD, DIRECTOR, GROUNDWATER PROGRAMS, ENVIRONMENTAL AND ENERGY STUDY INSTITUTE

Ms. **Campbell-Bird**. Thank you, good morning. I am really pleased, and want to express my gratitude for the opportunity to testify before you this morning.

I will try to make my comments as brief as possible, and hope that you will submit my statement for the record.

Senator **Bradley**. Your statement will be in the record in full.

Ms. **Campbell-Bird**. Before I begin, let me just very briefly describe the Institute and the process through which we arrived at our groundwater recommendations which I will explain to you this morning.

The Environmental and Energy Study Institute is a nonpartisan policy organization that was founded by the leaders of the Congressional environmental and energy study conference.

Our purpose is to provide better informed debate and independent analysis for policy initiatives.

Groundwater protection was the very first issue that our Institute addressed. With the help of a working group of experts in the field, we developed an 18-month investigation of Federal groundwater policy alternatives in order to provide Congress with an agenda for action on groundwater protection.

We began the project back in March of 1985 with a Congressional symposium, which was attended by over 250 Members of Congress, their staffs, and other Washington policymakers.

But the real heart of this agenda-setting process was a series of six regional conferences we held around the country. We believed it was critically important to get input from people all over the country who were already involved in groundwater protection activities, be they from business, industry, government, or active citizen leaders.

More than a thousand people attended these meetings, which were cochaired by Members of Congress.

Finally, we brought together sixty leaders from around the country in a National policy development workshop. These leaders represented a diverse array of interests, to test out the most promising of the ideas that were revealed through our conferences.

Out of this process, and numerous other discussions, we found that the Nation needs to build a capacity for protecting groundwater at all levels of government, and in the public sector as well.

The capacity needed from the Federal Government is what we have designated as our agenda for Congressional action.

Our findings and recommendations are not based on complete consensus, but surprisingly, there was consensus more often than not; and in all cases, it does represent areas of broad agreement.

Our recommendations are detailed in a report, A Congressional Agenda to Prevent Groundwater Contamination: Building Capacity for Protection Needs, which was released last October.

And we would like to have that included in the record as well.

The Institute found throughout our discussions that a phased approach to groundwater protection is needed. Not all the science about the resource is known, and although Congress and various Federal agencies and State and local governments have taken a great number of positive steps, we really still do not have enough experience to be absolutely certain of the best approach.

Still, we found that existing and potential groundwater pollution is serious and demands concerted action. It is a National problem, and requires a National solution.

Congress cannot wait until all the data are in and we have needed experience.

We suggest that Congress should act now to do the things that we know need to be done, and later evaluate progress and make any needed improvements.

But what kind of legislation do we suggest? The Institute that legislation is needed which establishes national leadership; not a big new Federal regulatory program at this time.

Legislation should set up an aggressive program, but with a nontraditional approach. It needs to provide some new funds, but most importantly, it needs to better direct and better harness the resources and programs that we have already.

We found general agreement on three fundamental elements of a groundwater protection program. Congress should first enact a National prevention based goal; second, put States in charge of meeting that goal; and third, mandate Federal agency initiatives to get the Federal Government's own house in order, and then to meet some real needs for building that capacity throughout the country.

First, let me describe the National goal. We found that there is no single accepted definition of the Nation's aim for its groundwater resource. Therefore, it is not clear what governments, businesses, or individuals really ought to be doing.

Inconsistencies have developed between States, between States and the Federal Government, between agencies, and even within responsibilities in a single agency.

People told us that a National goal is needed to provide clear direction and fundamental consistency for all of our efforts.

Views on what that goal should be obviously differ, but we found wide support for a goal of preventing contamination to the maximum extent possible. It is workable, it is realistic, and it is action-forcing.

It would require governments, industries, and individuals to do the very most they can, without waiting for the development of groundwater standards, without having to gather complete data on groundwater systems, and without having to customize responses to each groundwater situation.

It is true that Congress would have to examine a number of issues to operationally define what is possible under this goal, and some of those factors include technological feasibility, the differences between existing and new sources, the costs of prevention versus the costs of cleanup, and the extent to which siting options should be taken into account.

The Institute found, as has been mentioned here earlier today, that groundwater is a highly variable resource. It has traditionally been a State responsibility, and States therefore have different societal views as well as institutions for groundwater.

Furthermore, many people told us that traditional Federal programs delegated to the States stifle creativity, as State officials develop programs to meet detailed Federal requirements.

To respond to these problems, we suggest that Congress give States the responsibility, authority and flexibility to develop individual strategies and programs, but to meet the National goal.

Just as consistently as we heard that States should be given this flexibility, we heard that States must hold States accountable for actually doing the job.

Ultimately, it may very well be the threat of a direct Federal regulatory program which will drive States to live up to the challenge of a nontraditional flexible approach.

Let me briefly then discuss several Federal agency initiatives to build capacity for groundwater protection.

On the Federal level there are two that we need to pay particular attention to that apply to all agencies.

First, Congress should direct all agencies to reevaluate and redirect their programs to fall in line with and be consistent with the National goal that Congress lays out.

And secondly, Congress should direct all agencies to provide, and most importantly, fund, citizen education and participation programs.

People all over the country told us how important public education is to groundwater protection. Many of the sources of contamination, such as septic systems, hazardous household substances, pesticides, fertilizers, are directly related to individual actions, and people told us that public education is ultimately the very best tool that we have to prevent contamination from them.

Specifically, for the Environmental Protection Agency, our findings show that its work should be expanded to meet three real needs.

First, people often told us that they wanted to do the right thing, but they simply do not know what that is. We recommend that Congress direct EPA to prepare guidance, describing an array of methods, be they technologies, best management practices, or what have you, to prevent contamination from all sources.

This guidance should help governments to know what kind of programs and requirements they should establish, as well as it will help individuals and businesses to know what their best efforts actually are.

Secondly, we were told that Federal financial support for help in developing workable programs are essential to State action. And we suggest that EPA should expand the current grants and assistance programs which are underway.

Finally, we found that improved technologies for preventing contamination simply are not being used, because people do not know about them, because they are not sure of the capabilities of those technologies, or because there are impediments to the use of those technologies in existing permitting programs.

We recommend that EPA not only establish research and development programs, but also establish a technology transfer program, establish a mechanism for certifying the performance of new technologies, and evaluate and modify its current permitting procedures.

Secondly, the Institute found——

Senator **Bradley**. Could you wrap it up? We are getting pressed.

Ms. **Campbell-Bird**. I will indeed—must provide some basic information and technical assistance on the groundwater resource.

We found that many of the existing contamination problems are caused by this lack of knowledge.

We were told again and again that the U.S. Geological Survey is the most appropriate agency for cataloguing and disseminating this information, and recommend that the USGS establish National groundwater information clearinghouse and a program of technical assistance to State and local governments.

The USGS can provide the central place where people can look for help in protecting groundwater.

Finally, the Institute found increasing concern across the country about groundwater contamination from agricultural chemicals. While we did not set out to make recommendations about farm policies, we cannot ignore the fact that farmers and agricultural specialists in many parts of the country told us that groundwater contamination by these chemicals is rooted in U.S. foreign policies over the last 20 years.

These policies have emphasized maximum production rather than farm profitability and protecting the total farming resource.

We have also made recommendations for the U.S. Department of Agriculture, so that these policies could be shifted from ones of maximum production to those of reducing the use of chemicals yet maintaining profitability and protecting groundwater.

In conclusion, I would just like to say that we do believe the Federal Government has a very important role to play; that Congress should establish a National goal; that it should give States primarily the responsibility for designing programs to achieve that goal; and should mandate Federal agencies to take certain actions which would enable all levels of government to deal with these problems more effectively.

Thank you very much.

[The prepared statement of Ms. Campbell-Bird follows:]

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# STATEMENT

OF

ENVIRONMENTAL AND ENERGY STUDY INSTITUTE

BY

JUDY CAMPBELL BIRD

BEFORE

SENATE COMMITTEE ON ENERGY AND NATURAL RESOURCES

SUBCOMMITTEE ON WATER & POWER

JUNE 18, 1987

Mr. Chairman, I am Judy Campbell Bird, director of the groundwater program for the Environmental and Energy Study Institute. We appreciate the opportunity to testify before Senate Energy and Natural Resources Subcommittee on Water and Power on the protection of this important national resource. I would like to submit my written statement for the record and summarize key points orally, Mr. Chairman.

Before I begin my remarks about needed federal action to protect groundwater, I will briefly describe the Institute and the process through which we arrived at our groundwater policy recommendations.

The Environmental and Energy Study Institute is a non-partisan public policy organization founded by the leaders of the Congressional Environmental and Energy Study Conference and other national policymakers. Our goal is to meet the need for better informed debate and independent analysis and policy initiatives.

Groundwater protection was the first issue the Institute addressed. With the help of a working group of experts in the field, we developed an 18-month investigation of policy options which would provide Congress an agenda of actions needed to protect groundwater. The project began with a Congressional symposium held in March 1985, which was attended by more than 250 Members of Congress, staff and other policymakers. The heart of the agenda-setting process was a series of six regional conferences designed to get first-hand input from government, business and citizen leaders who are actually working to protect groundwater across the country. More than 1000 people attended these meetings, which were co-chaired by Members of Congress. We then held a national policy development worksnop which brought together about 60 leaders in the field representing diverse interests to test out the most promising ideas revealed in the conferences.

Out of this process and numerous other discussions, the Institute found that the nation must build a capacity to protect groundwater at all levels of government and in the private sector. The capacity needed from the federal government has become our agenda for Congressional action. Our findings and recommendations are not a complete consensus, but, surprisingly, they represent consensus more often than not. In all cases, they reflect broad agreement seen in our conferences. Our recommendations are detailed in a report, A Congressional Agenda to Prevent Groundwater Contamination: Building Capacity to Meet Protection Needs, which was issued last October. The report has been approved unanimously by the Institute's Board of Directors, a diverse group of government, corporate and environmental leaders. With your permission, Mr. Chairman, I would like to submit it for the record.

## FINDINGS AND RECOMMENDATIONS

The Institute found that a phased approach to groundwater protection legislation is needed. Groundwater contamination is an emerging public policy issue. Not all the science surrounding its contamination and protection is known. Although Congress, the Environmental Protection Agency (EPA) and other federal agencies, states and localities have taken positive steps, the nation does not have enough experience with current protection programs to be certain of the best approach.

Still, we found widespread agreement that existing and potential groundwater pollution is a serious problem, demanding concerted action now. It is a national problem requiring a national solution. And Congress cannot afford to wait until more data are in and we have more experience. It should act now to do the things we know must be done and later evaluate progress and make needed improvements with the benefit of more scientific information and experience.

But, what kind of legislation is needed now? The Institute found that legislation is needed which establishes national leadership, not a big new federal regulatory program at this time. The legislation should set up an aggressive program, but with a non-traditional approach, unlike those established in the clean air and water laws. It needs to provide some new funds for groundwater protection, but as importantly, it needs to better harness and redirect existing resources and programs.

The Institute found agreement on three fundamental elements of a federal groundwater protection program which can be put in place now, and modified as need be later. Congress should:

1. Enact a national prevention-based goal for groundwater protection.

2. Put states in charge of meeting the goal.

3. **Mandate federal agency initiatives to get the federal** government's own house in order and to meet real needs seen as critical to the country's capacity to protect groundwater.

## National Goal

The Institute found that there is no accepted definition of the nation's aim for the groundwater resource. Therefore, it isn't clear what governments, businesses or individuals should be doing to protect it. Inconsistencies in policies have arisen between states, between states and the federal government and between federal agencies.

People told us a national goal is needed to provide clear direction and fundamental consistency for all our efforts.

Views on what that national goal should be fall into very different philosophical camps, with non-degradation at one end, and differential protection according to various actual groundwater uses at the other. Debate on these and other goal options could probably go on indefinitely. However, the Institute found wide support for an alternative goal--preventing contamination to the maximum extent possible. It is workable, realistic and action-forcing. It would require governments, industries and individuals to do the most they can to prevent contamination -- without waiting for the development of groundwater quality standards, without having to gather complete data on each groundwater system and without having to customize a response to each groundwater situation.

Congress would have to examine a number of issues in order to operationally define what is "possible" under this goal. Among the factors Congress should consider are technological feasibility, differences between existing and new sources, the costs of prevention versus the costs of clean-up and the extent to which siting options should be taken into account.

**State Implementation**

The Institute found that groundwater is a highly variable resource with different soils and geologies dictating different actions to prevent contamination in different locations. No one national rule can provide the protection necessary for all situations. Also, groundwater has traditionally been a state responsibility; therefore, states have different societal views and institutions for groundwater. Many people told us that traditional federal programs delegated to states stifle creativity as state officials develop programs to meet detailed federal requirements.

To respond to these problems that a traditional federal resource protection program would likely encounter, the Institute recommends that Congress give states the responsibility, authority and flexibility to develop individual strategies and programs to meet the national goal. As a California official said, "We need a new kind of federal/state/local partnership without the hierarchy of senior partner/junior partner. We need the flexibility to meet the objective but perhaps to do it in a little different way."

However, just as consistently as the Institute heard that states should be given flexibility to meet the goal, we heard that the federal government must hold states accountable for actually doing the job. Congress might consider a variety of actions to hold states accountable. These include giving EPA broad authority to develop and implement strategies and programs for states that fail to do so, providing authority for states to sue adjoining states and providing for citizens to sue recalcitrant states. Ultimately, however, it may well be the threat of a direct, federal regulatory program which will drive states to live up to the challenge of the non-traditional, flexible approach to groundwater protection we recommend.

## Federal Agency Initiatives To Build Capacity

On the federal level, the Institute found that Congress should mandate federal agencies to take certain initiatives critical to building the nation's capacity to prevent groundwater contamination. They are not glamorous, they are not often given priority, and they are the first items taken out of agency budgets. But, we found they are vital to a program which relies on state and local implementation. They will provide federal leadership and federal commitment to making groundwater protection really work.

## Initiatives for All Agencies

The Institute recommends that Congress direct all federal agencies to evaluate their policies and programs which may have an impact on groundwater and redirect them where necessary to meet the national goal. This action would provide needed consistency within the federal government and would show federal leadership to states and local governments as they develop their own groundwater protection strategies.

We also recommend that Congress direct all agencies to provide and fund citizen education and participation programs for their activities which have an impact on groundwater. People all over the country told us that public education and participation are the heart of any successful groundwater protection effort.

Many sources of contamination, such as septic systems, hazardous household substances and pesticides and fertilizers, are directly related to individual actions. Conference participants in every region said public education is the best tool to prevent contamination from them. As one researcher told us, "We give great lip service to a policy of prevention, but we don't recognize that a policy of prevention implies money for a good education program."

## Initiatives for EPA

Based on our findings, the work of the Environmental Protection Agency should be expanded to meet three real needs for groundwater protection.

First, people often told us they want to do the right thing, but they don't know what that is. We recommend that Congress direct EPA to prepare guidance describing an array of "best possible" methods to prevent contamination from all potential sources. This guidance should help governments know what kinds of programs and requirements to establish and should help industries and individuals know what their best efforts to prevent contamination would be.

Second, we were told that federal financial support and help in developing workable programs are essential to state action to protect groundwater. The Institute recommends that Congress mandate EPA to expand current grants and assistance to states to develop groundwater protection strategies and programs.

Third, we found that improved technologies are not used because people do not know about them, because they are not certain of the capabilities of new technologies or because there are impediments to their use in current regulatory permitting programs. The Institute recommends that EPA not only establish a technology research and development program, but also establish a technology transfer program, establish a mechanism for certifying the performance of new technologies and evaluate and modify current regulations and permitting procedures.

### Initiatives for the U.S. Geological Survey

The Institute found that the federal government must provide basic information and technical assistance on the groundwater resource and contamination sources to encourage and enable state and local governments to make sound decisions which will prevent groundwater contamination. We found that many contamination problems stem from a lack of knowledge by decision makers about aquifers and the ways they may become contaminated. Data needs to be collected in a way that it will answer these questions critical to making sound decisions, and that data needs to get to those responsible for the decisions.

Although several federal agencies are or will be collecting information useful in making decisions that effect groundwater, we were told again and again that the U.S. Geological Survey (USGS) is the most appropriate agency for cataloging and disseminating this information. It has a staff with experience and expertise in collecting groundwater data and an excellent working relationship with most states and many localities through its district offices.

Specifically, we recommend that the USGS establish a national groundwater information clearinghouse and a program of technical assistance to states and local governments. The USGS can provide that needed central place to turn for help to protect groundwater.

## Initiatives for the U.S. Department of Agriculture

The Institute found increasing concern across the country about groundwater contamination from agricultural chemicals, both pesticides and fertilizer. It was the only source of contamination brought up by participants at each of our regional conferences.

Although the Institute did not set out to make recommendations about farm policies, we cannot ignore the fact that farmers and agricultural specialists in many parts of the country told us groundwater contamination by agricultural chemicals is rooted in U.S. farm policies over the last 20 years. These policies have led farmers to maximize production with little attention to farm profitability or to protecting the total farming resource, that is the land and surface and ground water.

First, we recommend that the U.S.Department of Agriculture (USDA) promote realistic, as opposed to maximum production goals, through all its policies and programs. Production goals should be based on factors which include historical yield records, variations in climatic conditions, long-term efficient use of the land, water, nutrients and agricultural chemicals and integrated protection of our land and ground and surface water resources.

Second, the Institute recommends that the USDA evaluate and redirect its programs which have an impact on groundwater. We found that some methods of preventing soil erosion and water runoff such as terracing and no-till farming may hold chemicals in soils where they leach into groundwater or may necessitate the increased use of chemicals. Other methods, like contour-stripping, can reduce run-off and erosion and the amount of chemicals needed.

Third, we recommend that Congress direct agricultural research toward how to determine accurate, realistic yield goals, toward developing more efficient chemical use and toward improving farming practices which would protect resources and sustain agriculture rather than only increase production.

Fourth, the Department of Agriculture should provide information and assistance to farmers through the USDA Extension Service on how to set realistic yield goals for particular acreages and how to develop pest control and crop nutrient plans which reduce the use of agricultural chemicals while maintaining profitability and realistic production.

## Conclusion

To summmarize our recommendations, Mr. Chairman, the Institute has concluded, based on extensive discussions with people around the country, that the federal government does have an important role to play in protecting the nation's groundwater resources. Congress should establish a clear national goal to guide governmental and private actions - a goal to prevent contamination to the maximum extent possible. It should give primary responsibility for designing plans and programs to achieve that goal to the states and should hold them accountable for doing so. It should manadate all federal agencies to revise existing programs to work toward the goal and mandate specific additional activities by the EPA, USGS and USDA to further the prevention of contamination.

In conclusion, Mr. Chairman, I would like to commend you and the other Members of the Subcommittee for your attention to this difficult but important issue. I would be pleased to answer any questions you may have now or later, as you continue to examine federal groundwater protection policy options.

Senator **Bradley**. Thank you very much.
Mr. Jaffe.

## STATEMENT OF MARTIN S. JAFFE, ASSOCIATE PROFESSOR, UNIVERSITY OF ILLINOIS AT CHICAGO, ON BEHALF OF THE AMERICAN PLANNING ASSOCIATION

Mr. **Jaffe**. My name is Martin Jaffe, and I am an Associate Professor of Urban Planning and Policy, at the University of Illinois at Chicago. For the past five years or so, I have been engaged in research examining local groundwater protection programs, as well as the State context in which they have been developed. I have coauthored a book on the topic and have also presented papers at professional and academic conferences and symposia on the subject of local groundwater protection. A lot of my research used technical studies and reports generated both by the U.S. Environment Protection Agency and by the U.S. Geological Survey.

The testimony this morning is being presented on behalf of the American Planning Association, which is the national planning organization comprising over 20,000 individual members at all levels of government. The APA considers groundwater protection to be one of the most critical environmental management issues in the United States, and supports Federal initiatives to establish coordinated and comprehensive programs to address this topic. The association realizes the difficulty and expense of cleanup and acquifer rehabilitation, and therefore believes that groundwater protection should be the most effective and economical focus of Federal management efforts. The APA also believes that such programs should be carried out by the lowest level of government with jurisdiction and authority over the acquifer or recharge area.

Based on my research, to make it short and sweet, I have basically three suggestions: more money; more technical assistance; and more basic research. Generally, more money is needed by all levels of government—Federal, State and local—since groundwater monitoring and hydrogeological investigations are both technically comlex and very expensive to undertake.

These technical studies must underlie any type of groundwater protection planning in the United States. When I examined the local and regional groundwater protection programs that are in place in the United States, I found that many of the most prominent state-of-the-art efforts, such as those on Long Island, Cape Cod, or in southeast Florida, are not really in the vanguard of current groundwater protection initiatives. Rather, they are the culmination of past efforts in the 1970's that were directed toward areawide water quality management planning, funded under Section 208 of the Clean Water Act.

Currently, many of the communities that are putting into place these effective programs are building on a data base, and building on planning efforts, that were initiated a decade ago.

The most sophisticated and comprehensive of these programs are probably the ones underway in Dade and Broward Counties in southeast Florida. I think it is instructive to realize that these sophisticated programs are largely supported by surcharges imposed on water users of these water supply systems. Therefore, I suggest that Congress may want to consider a similar approach when it is looking for various types of funding mechanisms to support groundwater protection efforts.

In other words, a comprehensive Federal groundwater protection initiative should perhaps require or encourage metering of all community public water supply systems. This would establish a rate base and also serve as a basic water conservation measure. Secondly, legislation should authorize some type of surcharge, so that adequate revenues can be directed toward groundwater protection by both State and Federal agencies. Essentially, what I am proposing is the establishment of a user-based water quality trust fund, so that the users of the resource help pay for its protection.

In terms of the second major need, technical assistance, I think that, as the State and Western resource people mentioned earlier, there is a critical need for additional groundwater data. What is often overlooked is that this data must be in a format that is useful to nonexpert elected officials and program administrators at both the State and local levels of government. That means that the research that is generated and the data that is collected must be interpreted in order to make it useful.

Generally, the information that is most needed for groundwater planning and groundwater protection is hydrogeological data. There has to be a lot more aquifer mapping, a lot more assessments of relative vulnerability of groundwater resources, a lot more evaluations of groundwater flow, and more basic data collection examining the interrelationship between ground and surface water. There also has to be more data developed on groundwater use, examining exactly how much groundwater has been withdrawn at which locations and for what purposes. That suggests that more effort has to be spent on resource inventory and mapping tasks.

A lot more data is also needed to better assess groundwater threats, both in terms of baseline ambient groundwater quality data and information on both regulated and unregulated sources. This information should include those sources that are currently addressed by Federal environmental legislation, as well as those sources, like septic systems or highway deicing salts, that are currently not addressed on the Federal level. Operationally, it is probably better to have the Federal Government develop uniform and consistent data bases, leaving the interpretation and application of this information to the States, since they can tailor it to meet their own needs and their own administrative structures and responsibilities.

In terms of data needed for local groundwater protection programs, I also direct the subcommittee's attention to the U.S. Supreme Court's *First Lutheran Church* v. *Los Angeles County* decision last week dealing with regulatory takings. If local governments are to regulate various types of sources through land use controls, this State and Federal data will be critical in sustaining these local programs against legal attack.

In terms of the last need, that of basic research, the subcommittee should note that many States are developing their own basic research agenda. I think you also have to realize that the States' resources are very limited, and that there is also the possibility that these limited resources may be redirected toward contamination assessment and cleanup efforts instead of toward prevention. Therefore, I think you have to look to the Federal agencies, which are more immune from these reactive demands, to undertake this longer-term basic research.

What I believe is most needed in terms of basic research are what I call nonexpert risk assessment models. I think the research focus should also be on the areas that are initially designated under the Safe Drinking Water Act as wellhead protection areas. This focus addresses the most critical public health concerns, and builds on the strong nondegradation policy within wellhead protection areas. This research focus also circumvents the current controversies about differential protection, limited protection, and nondegradation policies in the formulation of groundwater protection strategies. I also believe that if State and local governments can master coordination and management in these vulnerable areas, then they can establish resources protction models that can be later applied community wide or Statewide.

Finally, as a conclusion, I think you have to look at the long range results of the programs that you may be putting into place today. Again, like the earlier water quality management programs in the early 1970s that are just now bearing fruit, I think you have to realize that you can expect to reap the harvest of anything you put into place today perhaps a decade down the line. So I caution you to be patient.

Senator **BRADLEY**. A decade?

Mr. **JAFFE**. Pardon?

Senator **BRADLEY**. A decade?

Mr. **JAFFE**. Perhaps, yes.

[The prepared statement of Mr. Jaffe follows:]

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# STATEMENT OF

***MARTIN S. JAFFE, AICP***

**ON BEHALF OF THE**

**AMERICAN PLANNING ASSOCIATION**

**BEFORE A HEARING OF THE**

**WATER AND POWER SUBCOMMITTEE**

**ENERGY AND NATURAL RESOURCES COMMITTEE**

**U.S. SENATE**

**on**

**GROUNDWATER PROTECTION**

**June 18, 1987**

CHAIRMAN BRADLEY AND MEMBERS OF THE SENATE WATER AND POWER SUBCOMMITTEE:

MY NAME IS MARTIN S. JAFFE. I AM ASSOCIATE PROFESSOR IN THE SCHOOL OF URBAN PLANNING AND POLICY AT THE UNIVERSITY OF ILLINOIS AT CHICAGO. I AM AN ATTORNEY AND A PROFESSIONALLY TRAINED URBAN AND REGIONAL PLANNER. PREVIOUSLY, I WAS EDITOR OF *LAND USE LAW AND ZONING DIGEST*, PUBLISHED BY THE AMERICAN PLANNING ASSOCIATION.

I HAVE FOCUSED ON THE SUBJECT OF TODAY'S HEARING FOR OVER THE PAST FOUR YEARS AND HAVE WRITTEN EXTENSIVELY ON PLANNING FOR GROUNDWATER PROTECTION. IN ADDITION, I HAVE PARTICIPATED IN NATIONAL SYMPOSIA ON GROUNDWATER POLLUTION CONTROL AND PRESENTED PAPERS BEFORE PROFESSIONAL ASSOCIATIONS ON THIS TOPIC. I AM A MEMBER OF THE ILLINOIS GROUNDWATER ASSOCIATION AND I AM ALSO A MEMBER OF THE U.S. ADVISORY COMMITTEE OF A PROJECT ADDRESSING LONG-TERM WATER POLLUTION OF THE ORGANIZATION FOR ECONOMIC DEVELOPMENT.

I AM TESTIFYING ON BEHALF OF THE AMERICAN PLANNING ASSOCIATION OF WHICH I AM A MEMBER. I RESPECTFULLY REQUEST THAT THE COMPLETE TEXT OF MY PREPARED STATEMENT BE INCLUDED IN THE HEARING RECORD.

THE AMERICAN PLANNING ASSOCIATION IS A NATIONAL ORGANIZATION OF 21,000 MEMBERS, INCLUDING PUBLIC AND PRIVATE PLANNERS AND ELECTED AND APPOINTED OFFICIALS AT ALL LEVELS OF GOVERNMENT AS WELL AS EDUCATORS, STUDENTS AND INTERESTED CITIZENS. OUR MEMBERS BELONG TO 45 CHAPTERS COVERING EVERY STATE AND CONGRESSIONAL DISTRICT.

APA WAS FORMED IN 1978 WHEN THE AMERICAN INSTITUTE OF PLANNERS, ESTABLISHED IN 1917, AND THE AMERICAN SOCIETY OF PLANNING OFFICIALS, FOUNDED IN 1934, WERE CONSOLIDATED. THE ASSOCIATION'S PRIMARY OBJECTIVE IS TO ADVANCE THE ART AND SCIENCE OF PLANNING FOR THE IMPROVED DEVELOPMENT OF THE NATION AND ITS COMMUNITIES, STATES AND REGIONS. WITHIN APA IS THE AMERICAN INSTITUTE OF CERTIFIED PLANNERS WHICH FOCUSES ON PROFESSIONAL DEVELOPMENT, OF WHICH I AM A MEMBER. MEMBERS OF AICP ARE DISTINGUISHED BY HAVING MET EXPERIENCE

REQUIREMENTS AND HAVING PASSED AN EXAMINATION ON PLANNING PRINCIPLES AND PRACTICES.

IN SPEAKING FOR THE AMERICAN PLANNING ASSOCIATION, I WILL FOCUS ON:

- DATA NEEDS FOR GROUNDWATER PROTECTION WHICH ARE BASED ON APA'S RESEARCH;
- THE NEED FOR IMPROVED COORDINATION; AND
- ADDITIONAL RESEARCH NEEDS.

OVER THE PAST HALF-DECADE, GROUNDWATER PROTECTION HAS BEEN A SPECIAL CONCERN OF OUR ORGANIZATION. DURING 1985-86, UNDER FUNDING FROM THE JOYCE AND HEWLETT FOUNDATIONS, APA PUBLISHED A MANUAL, *LOCAL GROUNDWATER PROTECTION: MIDWEST REGION*, WHICH SURVEYS CURRENT PLANNING AND MANAGEMENT PRACTICES IN THE SEVEN-STATE MIDWEST REGION. AS PART OF THIS RESEARCH EFFORT, APA SPONSORED A CONFERENCE ON LOCAL GROUNDWATER PROTECTION, HELD IN CHICAGO IN 1983, THAT DREW PARTICIPANTS FROM THROUGHOUT THE MIDWEST REGION AND SERVED AS A FORUM FOR THE IDENTIFICATION OF GROUNDWATER THREATS, MANAGEMENT PRIORITIES, AND REGULATORY STRATEGIES. PRESENTATIONS ON GROUNDWATER PROTECTION HAVE ALSO BEEN GIVEN AT THE APA'S ANNUAL ZONING INSTITUTE AND AT THE ORGANIZATION'S ANNUAL PLANNING CONFERENCE, AS WELL AS AT A MEETING OF THE ILLINOIS GROUNDWATER ASSOCIATION. IN 1987, THE REGIONAL MANUAL WAS EXPANDED INTO A FULL-SCALE BOOK, *LOCAL GROUNDWATER PROTECTION*, WHICH I CO-AUTHORED WITH FRANK DiNOVO. IT PRESENTS BASIC INFORMATION ON PLANNING FOR GROUNDWATER PROTECTION, SOURCES OF TECHNICAL INFORMATION, AND EXAMPLES OF PROGRAMS THROUGHOUT THE COUNTRY.

APA'S OWN *POLICIES ON ENVIRONMENTAL QUALITY* SUPPORT MANY OF THE FEDERAL ENVIRONMENTAL MANAGEMENT PROGRAMS WHICH ARE EITHER EMERGING OR ARE CURRENTLY IN PLACE TO PROTECT GROUNDWATER RESOURCES. APA'S SPECIAL CONCERN IS THAT THESE EFFORTS BE INTEGRATED INTO COMPREHENSIVE AND EFFECTIVE PLANNING PROGRAMS ON ALL LEVELS OF GOVERNMENT, BY ASSIGNING PROGRAM RESPONSIBILITIES TO THE SMALLEST

ENTITY AUTHORIZED TO PERFORM THEM AND BY DEVISING APPROPRIATE PAYMENT METHODS (AS OUTLINED IN SPECIFIC PLANS AND CAPITAL IMPROVEMENT PROGRAMS) TO SUPPORT SUCH ACTIVITIES.

THE ORGANIZATION'S POLICIES ALSO SUPPORT EFFORTS DIRECTED TOWARDS THE PROTECTION, CONSERVATION, AND EFFICIENT USE OF GROUNDWATER RESOURCES, ESPECIALLY MANAGEMENT AT THE STATE AND REGIONAL LEVELS CORRESPONDING TO THE EXTENT OF THE AQUIFER AND ITS RECHARGE AREA. IN PROMOTING SUCH EFFORTS, APA BELIEVES THAT PROPOSED PROJECTS AND LAND USE ACTIVITIES SHOULD BE EVALUATED FOR THEIR EFFECTS ON GROUNDWATER, IN ORDER TO ENCOURAGE EFFORTS TO MINIMIZE ADVERSE CONSEQUENCES, AND THAT SPECIAL PROTECTIVE MEASURES SHOULD BE EMPLOYED FOR SOLE-SOURCE AQUIFERS.

THE ORGANIZATION'S POLICIES ALSO CALL ON CONGRESS TO DEAL WITH THE CONTROVERSIAL ISSUES OF LANDFILL SITING, BY SPURRING THE DEVELOPMENT OF NATIONAL SITING STANDARDS; BY REQUIRING STATES TO ADOPT LANDFILL SITING LAWS PROVIDING FOR THE DEVELOPMENT OF STATE

SITING PLANS; AND BY REQUIRING AGENCY APPROVAL OF LANDFILL SITES. APA'S POLICIES ALSO ADVOCATE FUNDING OF BASIC RESEARCH TO DEVELOP STANDARDS TO PROTECT THE PUBLIC HEALTH AND WELFARE AND FUNDING OF APPLIED RESEARCH ON THE STORAGE AND DISPOSAL OF HAZARDOUS SUBSTANCES AND THE DEVELOPMENT AND INTEGRATION OF GEOGRAPHICALLY-BASED INFORMATION RESOURCES INTO STATE AND LOCAL PLANNING OPERATIONS.

## DATA NEEDS FOR GROUNDWATER PROTECTION

APA'S RESEARCH PROJECTS AND ENVIRONMENTAL POLICIES PROMOTE A VARIETY OF MEASURES TO PROTECT THE NATION'S GROUNDWATER RESOURCES AGAINST THREATS OF CONTAMINATION. TO A LARGE EXTENT, THESE VARIOUS MEASURES MERELY MIRROR THE COMPLEXITY OF COMPREHENSIVELY ADDRESSING POLLUTION RISKS THAT ARE CURRENTLY THE SUBJECTS OF A LARGE NUMBER OF EXISTING SINGLE-PURPOSE FEDERAL PROGRAMS AND LAWS. ALTHOUGH SOME OF THESE PROGRAMS FALL UNDER THIS SUBCOMMITTEE'S JURISDICTION, WHILE OTHERS LIE WITHIN THE JURISDICTION OF OTHER CONGRESSIONAL COMMITTEES, THIS INSTITUTIONAL FRAGMENTATION UNDERCUTS THE COORDINATION THAT STATE, REGIONAL, AND LOCAL

GOVERNMENTS NEED TO PUT INTO PLACE EFFECTIVE GROUNDWATER PROTECTION PLANS AND PROGRAMS.

APA'S EFFORTS HAVE EMPHASIZED GROUNDWATER PROTECTION OVER THE EQUALLY CRITICAL EFFORTS THAT ARE REQUIRED TO CLEAN UP OR RENOVATE CONTAMINATED AQUIFERS. ONCE GROUNDWATER RESOURCES HAVE BECOME CONTAMINATED, THEY CANNOT BE REHABILITATED EXCEPT AT GREAT COST AND EFFORT, IF AT ALL. **APA, THEREFORE, BELIEVES THAT STATE, REGIONAL AND LOCAL PLANS AND PROGRAMS TO PREVENT SUCH CONTAMINATION IN THE FIRST PLACE CONSTITUTE THE MOST EFFECTIVE AND ECONOMICAL APPROACHES THAT CAN BE ENCOURAGED BY THE FEDERAL GOVERNMENT.** HOWEVER, APA ALSO RECOGNIZES THAT THE INFORMATION REQUIRED TO UNDERTAKE THESE COMPREHENSIVE GROUNDWATER PROTECTION PLANS DIFFERS FROM DATA NEEDS THAT ARISE IN THE RESPONSE AND CLEAN-UP EFFORTS THAT HAVE DOMINATED GROUNDWATER MANAGEMENT PROGRAMS TO DATE.

GROUNDWATER PROTECTION PLANNING REQUIRES THREE INTEGRATED SETS OF DATA. FIRST, A GOOD HYDROGEOLOGIC DATA BASE IS REQUIRED TO ENABLE

EVALUATION OF AQUIFER CHARACTERISTICS, GROUNDWATER FLOW, AND AMBIENT GROUNDWATER QUALITY. SECOND, INFORMATION MUST BE GATHERED ON GROUNDWATER USE--HOW MUCH GROUNDWATER IS BEING USED, WHERE IT IS BEING WITHDRAWN, AND WHAT IT IS BEING USED FOR. FINALLY, INFORMATION ON VARIOUS GROUNDWATER THREATS MUST BE COLLECTED AND EVALUATED; THIS DATA MUST ADDRESS BOTH POINT AND NONPOINT SOURCES. MOREOVER, THE SCOPE OF ANALYSIS MUST INCLUDE NOT ONLY SOURCES THAT ARE MANAGED UNDER FEDERAL AND STATE LEGISLATION (SUCH AS HAZARDOUS WASTE FACILITIES), BUT ALSO SOURCES WHICH ARE CURRENTLY NOT OF NATIONAL CONCERN (SUCH AS THE USE OF ROADWAY DE-ICING SALTS BY HIGHWAY DEPARTMENTS) BUT WHICH STILL POSE SIGNIFICANT THREATS TO SURFICIAL AQUIFERS.

BASED ON APA'S PAST RESEARCH, THE ORGANIZATION CAN ONLY CONCLUDE THAT THE COLLECTION OF THIS INFORMATION IS BOTH AN EXPENSIVE AND DIFFICULT PROCESS. IN MANY LOCALES, CRITICAL DATA ELEMENTS SIMPLY DO NOT EXIST, AND MUST BE GENERATED FROM COMMUNITY-WIDE HYDROGEOLOGICAL INVESTIGATIONS AND BY STAFF-INTENSIVE FIELD SURVEYS. IN

OTHER JURISDICTIONS, DATA IS OFTEN INCOMPLETE (WITH AMBIENT WATER QUALITY DETERMINED FROM MONITORING OF PUBLIC WATER SUPPLY WELLS, FOR EXAMPLE, LEAVING UNEXPLORED THE CONTAMINATION RISKS FACING USERS OF ON-SITE DOMESTIC WATER SUPPLY WELLS). STILL, IN OTHER LOCALES, DATA IS OF TOO GROSS A SCALE TO BE APPLIED TO A PARTICULAR JURISDICTION (REQUIRING ADDITIONAL SUPPLEMENTARY INVESTIGATION OR A REDRAFTING OF EXISTING MAPS TO CONFORM TO SCALES IN USE WITHIN THE JURISDICTION).

IN MOST CASES, THE DIFFICULTY AND COSTS OF COMPILING THIS TECHNICAL INFORMATION LIMIT STATE AND LOCAL GROUNDWATER PLANNING INITIATIVES. AS A RESULT, STATES AND COMMUNITIES HAVE HAD TO RELY ON ALTERNATIVE FUNDING SOURCES TO DEVELOP THEIR PROGRAMS. DADE COUNTY, FLORIDA, AND SCHENECTADY COUNTY, NEW YORK, FOR EXAMPLE, HAVE FINANCED THEIR WELLFIELD PROTECTION EFFORTS BY SURCHARGES IMPOSED ON PUBLIC WATER SUPPLY USERS. OTHER INNOVATIVE PROGRAMS (SUCH AS THE ACTON, MASSACHUSETTS AQUIFER PROTECTION PLAN) WERE INITIATED IN RESPONSE TO A CONTAMINATION INCIDENT THREATENING PUBLIC WATER SUPPLIES; FINES AND CORRECTIVE ACTIONS BY AN IDENTIFIED POLLUTER--THE GRACE COMPANY, IN

ACTON'S CASE--UNDERWROTE THESE COMPREHENSIVE LOCAL PLANNING EFFORTS.

OTHER PLANNING PROGRAMS--SUCH AS THOSE IN PLACE ON CAPE COD, MASSACHUSETTS, IN SPOKANE COUNTY, WASHINGTON, OR ON LONG ISLAND, NEW YORK--AROSE FROM THE RESIDUAL EFFORTS OF PAST AREAWIDE WATER QUALITY MANAGEMENT PROGRAMS WHERE COMPREHENSIVE DATA COLLECTION WAS FUNDED IN THE 1970'S UNDER SECTION 208 OF THE CLEAN WATER ACT. MANY OF THESE PROGRAMS NO LONGER EXIST, YET THE DECADE-OLD DATA BASE DEVELOPED IN THESE COMMUNITIES STILL UNDERLAYS CURRENT PLANNING EFFORTS. IN ESSENCE, THESE "STATE OF THE ART" GROUNDWATER PROTECTION PROGRAMS DO NOT REPRESENT THE VANGUARD OF NEW RESOURCE MANAGEMENT INITIATIVES, BUT RATHER THE CULMINATION OF A PROCESS INITIATED OVER A DECADE AGO UNDER THE CLEAN WATER ACT'S PLANNING PROVISIONS.

DESPITE THESE SUCCESSES, THERE IS STILL A DESPERATE NEED TO DEVELOP A MORE COMPREHENSIVE DATA BASE ON THE STATE LEVEL TO ASSIST REGIONAL AND LOCAL GOVERNMENTS IN THE DEVELOPMENT OF THEIR OWN PLANS AND

PROGRAMS. INITIATIVES IN NEBRASKA, FOR EXAMPLE, MAY OFFER A POSSIBLE DIRECTION FOR THESE EFFORTS, WHERE REGIONAL ENTITIES DEVELOPED GROUNDWATER MANAGEMENT PLANS WITH ASSISTANCE FROM THE STATE GEOLOGICAL SURVEY. THE ESTABLISHMENT OF A STATEWIDE GROUNDWATER MONITORING NETWORK IN ILLINOIS MAY ALSO SUGGEST ANOTHER APPROACH, WHERE AMBIENT GROUNDWATER QUALITY IS BEING EVALUATED IN ORDER TO IDENTIFY AREAS AT GREATEST RISK FROM GROUNDWATER CONTAMINATION. AQUIFER MAPPING AND ASSESSMENT OF GROUNWATER FLOW AND VULNERABILITY REMAIN ESPECIALLY CRITICAL NEEDS FOR STATE AND LOCAL GOVERNMENTS CONCERNED WITH THE PROTECTION OF GROUNDWATER QUALITY.

THESE EFFORTS FALL WITHIN THE AREA OF APPLIED RESEARCH, AND ARE PROBABLY PROGRAMS THAT ARE MOST SUITABLE TO STATE ADMINISTRATION AND STATE TECHNICAL ASSISTANCE. ALTHOUGH STATE WATER AND GEOLOGICAL SURVEYS HAVE ALSO ADDRESSED BASIC RESEARCH--FOR EXAMPLE THE EVALUATION OF CONTAMINATION RISKS IN KARST TERRAINS BEING UNDERTAKEN IN IOWA AND MINNESOTA, OR THE DEVELOPMENT OF VARIOUS NITRATE CONTAMINATION MODELS BY THE ILLINOIS STATE WATER SURVEY AND THE NEW

YORK LEGISLATIVE COMMISSION ON THE WATER RESOURCES NEEDS OF LONG ISLAND--THESE INITIATIVES MAY BE BLUNTED, IN THE LONGER TERM, BY THE STATES' NEEDS TO ADDRESS CONTAMINATION INCIDENTS AND CLEAN-UP ISSUES. FEDERAL AGENCIES SUCH AS THE ENVIRONMENTAL PROTECTION AGENCY (EPA) OR THE U.S. GEOLOGICAL SURVEY ARE SOMEWHAT BETTER INSULATED FROM SUCH REACTIVE DEMANDS AND MIGHT THEREFORE BE MORE SUITABLE VEHICLES FOR UNDERTAKING THESE BASIC RESEARCH MISSIONS AND FOR DEVELOPING A NATIONAL DATA BASE ON GROUNDWATER RESOURCES AND VULNERABILITY THAT CAN SUPPORT STATE ASSISTANCE EFFORTS.

## COORDINATION NEEDS

AS MENTIONED EARLIER, SOME SOURCES ALREADY ARE REGULATED UNDER FEDERAL ENVIRONMENTAL PROTECTION LAWS WHILE OTHER SOURCES NOT ADDRESSED IN FEDERAL INITIATIVES MAY STILL POSE LOCALIZED CONTAMINATION THREATS TO AQUIFERS AND RECHARGE AREAS. THE DIVERSITY OF HYDROGEOLOGIC SETTING, GROUNDWATER USE PATTERNS, AND POTENTIAL SOURCES OF CONCERN GUARANTEE THAT EFFECTIVE MANAGEMENT WILL BE A LONG-TERM AND COMPLEX PROCESS, REGARDLESS OF THE LEVEL OF

GOVERNMENT GIVEN MANAGEMENT RESPONSIBILITY OVER GROUNDWATER RESOURCES. NO SINGLE APPROACH IS PROBABLY OPTIMAL FOR ALL SITUATIONS, WITH THE POSSIBLE EXCEPTION OF SIMPLY BANNING CERTAIN ACTIVITIES OUTRIGHT IN AREAS POSING UNACCEPTABLE RISKS TO THE PUBLIC HEALTH AND SAFETY. IF ECONOMIC GROWTH IS NOT TO BE CONSTRAINED, EFFECTIVE MANAGEMENT APPROACHES MUST BE TAILORED TO MEET LOCAL NEEDS AND CONDITIONS.

SOME EMERGING PROGRAMS BY EPA, ESPECIALLY THE WELLHEAD PROTECTION PROVISIONS OF THE 1986 SAFE DRINKING WATER ACT AMENDMENTS, OFFER THE POTENTIAL OF SERVING AS COORDINATION VEHICLES ALLOWING STATE AND LOCAL GOVERNMENTS TO ADDRESS A VARIETY OF SOURCES OF SPECIAL CONCERN IN WELLHEAD PROTECTION AREAS THAT ARE ESPECIALLY VULNERABLE TO CONTAMINATION RISKS.

IF STATES CAN DEVELOP EFFECTIVE COORDINATION AMONG DIVERSE PROGRAMS IN THESE DESIGNATED AREAS, THEN THE POSSIBILITY EXISTS OF EXTENDING THESE PROGRAMS STATEWIDE BEYOND THEIR PUBLIC WELLFIELD

FOCUS. RECHARGE AREAS AND CAPTURE ZONES OF PUBLIC WELLS ARE ESPECIALLY CRITICAL AREAS, SINCE PUBLIC HEALTH CONCERNS ESTABLISH VERY LOW RISK ACCEPTABILITY THRESHOLDS. THESE STATE-DESIGNATED AREAS CAN THEREFORE SERVE IMPORTANT FUNCTIONS AS THE LOGICAL PLACES FOR STATE AND FEDERAL AGENCIES TO UNDERTAKE APPLIED AND BASIC RESEARCH WHICH CAN BE READILY TRANSFERRED TO SIMILAR SETTINGS WITH SIMILAR SOURCES MANAGEMENT ISSUES ELSEWHERE IN THE NATION. THIS RESEARCH MUST EXTEND BEYOND THE MAPPING AND HYDROGEOLICAL INVESTIGATIONS USUALLY UNDERTAKEN BY SUCH AGENCIES, AND MUST ADDRESS THE INSTITUTIONAL AND POLICY COORDINATION ISSUES THAT ARE LIKELY TO ARISE IN CARRYING OUT THIS EVOLVING FEDERAL PROGRAM.

A RESEARCH AND DATA COLLECTION FOCUS ON WELLFIELD PROTECTION AREAS ALSO SIDESTEPS SOME OF THE POLICY DIFFERENCES THAT HAVE PLAGUED THE ESTABLISHMENT OF NATIONAL OR UNIFORM GROUNDWATER QUALITY STANDARDS IN THE NATION. EPA, FOR EXAMPLE, HAS ENCOURAGED GROUNDWATER CLASSIFICATION IN ITS OWN STRATEGY AND HAS INCORPORATED A TRIPARTITE CLASSIFICATION SCHEME IN ITS RESOURCE CONSERVATION AND

RECOVERY ACT (RCRA) FACILITY PERMIT REVIEWS. ALTHOUGH OVER A DOZEN STATES HAVE ADOPTED SIMILAR CLASSIFICATION PROGRAMS, CONTROVERSIES OVER NONDEGRADATION, LIMITED DEGRADATION, AND DIFFERENTIAL PROTECTION STILL REMAIN UNRESOLVED. IF PUBLIC WATER SUPPLY PROTECTION REMAINS THE PRINCIPAL FOCUS OF THE EMERGING COORDINATION EFFORTS, THEN NONDEGRADATION POLICIES ARE FAVORED IN SUCH SETTINGS.

DESPITE THE EXISTENCE OF WATER TREATMENT TECHNOLOGIES, IT WILL PROBABLY BE POLITICALLY UNACCEPTABLE TO EXPOSE PUBLIC WATER SUPPLY USERS TO HEALTH RISKS IMPLICIT IN A LIMITED DEGRADATION OR DIFFERENTIAL PROTECTION POLICY FOR WELLFIELD PROTECTION AREAS. THE ESTABLISHMENT OF A NATIONAL GROUNDWATER PROTECTION OBJECTIVE--POSSIBLY THE ACHIEVEMENT OF MAXIMUM CONTAMINANT LEVELS FOR THE 87 SUBSTANCES THAT EVENTUALLY WILL BE REGULATED UNDER THE SAFE DRINKING WATER ACT (SDWA) AS AN AMBIENT GROUNDWATER QUALITY GOAL, CONSISTENT WITH THE SUPERFUND AMENDMENT AND REAUTHORIZATION ACT'S AMBIENT MAXIMUM CONTAMINANT LEVELS (MCL) CLEAN-UP GOAL--ESTABLISHES A UNIFORMLY RESTRICTIVE BENCHMARK AGAINST WHICH TO GAUGE MANAGEMENT, COORDINATION, AND DATA COLLECTION EFFORTS WITHIN THESE DESIGNATED AREAS.

COORDINATION AMONG THE VARIOUS SOURCE CONTROL PROGRAMS IS DIFFICULT AT BEST, EVEN WHEN THE PROGRAMS ARE INTEGRATED IN A SINGLE FEDERAL AGENCY (SUCH AS EPA) OR WITHIN A SINGLE STATE AGENCY. FOR EXAMPLE, A SINGLE REGULATED SOURCE--SUCH AS LEAKAGE OF PETROLEUM PRODUCTS FROM UNDERGROUND STORAGE TANKS--MAY BE THE CONCURRENT RESPONSIBILITY OF SEVERAL AGENCIES (INCLUDING ENVIRONMENTAL PROTECTION AGENCIES, BOARDS OF HEALTH, LOCAL FIRE DEPARTMENTS, AND EVEN A LOCAL BUILDING CODE ADMINISTRATOR). IDENTIFYING THE RELEVANT ADMINISTRATIVE ENTITY (OR ENTITIES) WHO MUST ADDRESS THE POLLUTION DISCHARGE MAY BE DIFFICULT.

THESE DIFFICULTIES ARE FURTHER COMPOUNDED IN THE CASE OF SOURCES THAT ARE NOT CURRENTLY ADDRESSED IN FEDERAL OR STATE LEGISLATION--SUCH AS SEPTIC SYSTEM DISCHARGES--BUT WHICH CAN POSE UNACCEPTABLE RISKS TO GROUNDWATER QUALITY WITHIN THE CAPTURE ZONE OF A PUBLIC WATER SUPPLY

WELL IF INCREMENTAL DISCHARGES EXCEED AMBIENT CONCENTRATION LEVELS DEEMED SAFE UNDER THE SDWA. THE INCREMENTAL IMPACTS OF SUCH SOURCES POSE PARTICULARLY TROUBLESOME MANAGEMENT ISSUES WHICH CAN ONLY BE ADDRESSED BY PROSPECTIVE MODELING AND NOT BY REACTIVE MEASURES (SUCH AS THE EXPENSIVE INSTALLATION OF A PUBLIC SEWER SYSTEM OR THE OFTEN UNRELIABLE USE OF A PACKAGE TREATMENT PLANT). IF A SINGLE ENTITY TAKES RESPONSIBILITY FOR SUCH MODELING EFFORTS, THEN COORDINATION IS ENHANCED DESPITE CONFUSION OVER THE ULTIMATE ADMINISTRATIVE AUTHORITY FOR THE SOURCE WITHIN THE GOVERNMENTAL STRUCTURE. THIS IS A GOOD EXAMPLE OF HOW APPLIED OR BASIC RESEARCH CAN BEST ENHANCE COORDINATION WITHIN A FRAGMENTED ADMINISTRATIVE STRUCTURE.

## FUTURE DIRECTIONS

A VARIETY OF RESEARCH EFFORTS ARE NEEDED TO ENHANCE THE DATA NEEDED FOR STATE AND LOCAL GROUNDWATER PROTECTION PLANNING. UNDERTAKING THIS EFFORT AND COMPILING THE INFORMATION IN A FORM THAT IS MOST USEFUL TO STATE, REGIONAL, AND LOCAL AGENCIES MUST BE A LONG-TERM COMMITMENT OF FEDERAL AGENCIES INVOLVED IN SOURCE CONTROL AND

HYDROGEOLOGIC INVESTIGATION AND MAPPING. BECAUSE OF THE CRITICAL NEED TO ENCOURAGE INNOVATION AND THE DEVELOPMENT OF STATE AND LOCAL PROGRAMS TO PROTECT THE RESOURCE, INITIAL EFFORTS SHOULD PERHAPS BE PLACED ON DETERMINING WHAT INFORMATION CURRENTLY EXISTS WITHIN THESE LEVELS OF GOVERNMENT AND ON DETERMINING WHERE DEFICIENCIES IN THE DATA BASE EXIST THAT PREVENT ADEQUATE POLICY FORMULATION OR MANAGEMENT. ADDITIONAL EFFORT SHOULD BE DIRECTED TOWARDS GENERATING THE NEEDED DATA AND COMPILING IT IN A FORM THAT IS USEFUL TO A NON-EXPERT DECISIONMAKER OR AGENCY ADMINISTRATOR. THIS IS MOST LIKELY TO BE AN APPLIED RESEARCH RESPONSIBILITY OF STATE AND FEDERAL AGENCIES.

BASIC RESEARCH ON NATURAL ATTENUATION OF CONTAMINANTS, GROUNDWATER FLOW, AND RELATIVE VULNERABILITY OF AQUIFERS UNDER VARIOUS HYDROGEOLOGICAL SETTINGS IS ALSO A PRIORITY CONCERN. MUCH MORE NEEDS TO BE KNOWN ABOUT CONTAMINATION THREATS POSED BY VARIOUS SOURCES AND HOW THESE RISKS CAN BE ESTIMATED PRIOR TO THE ACTIVITY BEING ESTABLISHED IN A VULNERABLE LOCATION. THIS CERTAINLY

INVOLVES AQUIFER MAPPING AND HYDROGEOLOGICAL INVESTIGATION ON A WIDER SCALE THAN IS CURRENTLY THE CASE, BUT IT ALSO INVOLVES MORE BASIC INVESTIGATIONS INTO CONTAMINANT TRANSPORT AND FATE MECHANISMS, ESPECIALLY IN THE VADOSE ZONE AS WELL AS WITHIN THE AQUIFER ITSELF. SOME OF THE ANALYSES UNDERTAKEN AS PART OF SPILL RESPONSE AND CLEAN-UP EFFORTS SHOULD BE USEFUL TO THIS RESEARCH, BUT IT MUST EXTEND BEYOND LOCALIZED CLEAN-UP CONSIDERATIONS.

THESE TYPES OF STUDIES SHOULD BE DIRECTED TOWARDS EFFECTIVE MODELS AND RISK ASSESSMENTS THAT ARE CAPABLE OF BEING UNDERTAKEN QUICKLY AND INEXPENSIVELY BY LOCAL AND STATE NON-EXPERT OFFICIALS AND STAFF. IN THE SHORT-TERM, "FAST AND DIRTY" METHODOLOGIES WOULD PROBABLY BE OF GREATER UTILITY THAN SOPHISTICATED APPROACHES; THE PRELIMINARY METHODS CAN ALWAYS BE UPGRADED OVER TIME AS KNOWLEDGE INCREASES. THESE APPROACHES ARE NEEDED TO ESTABLISH APPROPRIATE MANAGEMENT PRIORITIES FOR REGULATED AND UNREGULATED SOURCES, AND TO REPLACE THE REACTIVE SETTING OF MANAGEMENT ISSUES THAT CURRENTLY IS THE RULE WHEN GROUNDWATER PLANNING IS DICTATED BY THREATS TO PUBLIC

WATER SUPPLIES IDENTIFIED BY CURRENT MONITORING REQUIREMENTS. SUCH MODELS WOULD ALSO ENABLE STATE AND LOCAL AGENCIES TO PREDICT BEFOREHAND THE RELATIVE RISKS OF VARIOUS ALTERNATIVE SOURCES AND ACTIVITIES PRIOR TO A CONTAMINATION INCIDENT EMERGING. PROCEDURES FOR EVALUATING THE CUMULATIVE POLLUTION THREATS OF UNREGULATED SOURCES WOULD BE ESPECIALLY USEFUL FOR GROUNDWATER PROTECTION PURPOSES.

FINALLY, MORE RESEARCH IS NEEDED ON THE APPROPRIATE MANAGEMENT MECHANISMS THAT CAN BE EMPLOYED TO PROTECT AQUIFERS AND PUBLIC WATER SUPPLIES FROM CONTAMINATION RISKS. CURRENTLY, EMPHASIS HAS BEEN DIRECTED TOWARDS ENGINEERING REQUIREMENTS ARISING FROM STATE AND FEDERAL SOURCE PERMIT REVIEWS, BUT THESE MAY HAVE LIMITED RELIABILITY OVER THE LONG RUN AND MAY POSE UNACCEPTABLE RISKS IN CERTAIN LOCATIONS. IN RESPONSE TO THE INDETERMINANCY OF PERMIT REVIEW AND ENGINEERING, MANY COMMUNITIES HAVE SIMPLY BANNED CERTAIN ACTIVITIES (SUCH AS THOSE INVOLVING THE USE, STORAGE, OR DISPOSAL OF TOXIC MATERIALS) WITHIN CERTAIN SENSITIVE LOCATIONS. A MIDDLE GROUND MUST BE FOUND BETWEEN AN ABSOLUTE BAN AND AN UNRELIABLE CONTAINMENT

TECHNOLOGY IN ORDER TO ACHIEVE REASONABLE ASSURANCES THAT NONDEGRADATION OBJECTIVES CAN BE MET IN ESPECIALLY CRITICAL AREAS (SUCH AS PUBLIC WELL CAPTURE ZONES).

IN CONCLUSION, WE HOPE THAT THE CONGRESS WILL PROVIDE THE NECESSARY SUPPORT TO CONTINUE THE COLLECTION AND ANALYSIS OF DATA THAT ARE SO ESSENTIAL TO PLANNING FOR THE PROTECTION OF OUR COMMUNITIES' GROUNDWATER.

THANK YOU FOR THE OPPORTUNITY TO EXPRESS THE VIEWS OF THE AMERICAN PLANNING ASSOCIATION ON THIS SUBJECT. WE WOULD BE DELIGHTED TO ASSIST THE SUBCOMMITTEE IN THIS IMPORTANT MATTER AND RESPOND TO YOUR QUESTIONS.

Senator **Bradley**. Let me thank both of you very much. I just have two quick questions for each of you.

Ms. Campbell-Bird, you say that the Institute found wide support for an alternative goal preventing contamination to the maximum extent possible.

Does that differ from a nondegradation standard?

Ms. **Campbell-Bird**. Yes. Nondegradation would be what people define it who support it would be a standard which would say, there will be no.

What we are saying is that you must do the best that is possible, you must do the most that you can.

It does tie it to technology's practices and so forth.

Senator **Bradley**. Okay, thank you very much.

Professor Jaffe, you made a number of very interesting suggestions. Now one of them is that there would be mandatory metering?

Mr. **Jaffe**. Yes, I would think metering should be encouraged in order to indicate the need for groundwater conservation as well as to develop a consistent database.

Senator **Bradley**. And then are you suggesting a Federal user fee on water?

Mr. **Jaffe**. I do not know which level of government should establish it. But I think it offers a possibility of developing an independent source of funding.

Senator **Bradley**. So you suggest a Federal user fee to be put in a groundwater trust fund for research and developing or mapping or the variety of other needs?

Mr. **Jaffe**. That is one option. Such things can also be instituted at the local level or the State level.

Senator **Bradley**. And then what was your point on the recent Supreme Court ruling and the need for data?

Mr. **Jaffe**. Essentially, the U.S. Supreme Court decision in *First English Evangelical Lutheran Church of Glendale* v. *County of Los Angeles* on June 9th held that there can be potential local government liability for regulatory takings under the takings clause of the Fifth Amendment of the U.S. Constitution.

The Court did not rule on whether a taking had actually occurred in that case but with the potential of liability, I think a good database is necessary in order to enhance the defensibility of local land use controls and health restrictions.

Senator **Bradley**. And a good data base that is not presently related to groundwater now?

Mr. **Jaffe**. I think what you find is that it is very spotty.

Senator **Bradley**. You mean spotting in place, or spotty in methology.

Mr. **Jaffe**. Generally spotty in place.

Senator **Bradley**. Some places they do it; some places they do not do it.

Mr. **Jaffe**. Well, they have good data on some aspects of water management, but not on others.

Senator **Bradley**. So you think the data should essentially be developed by a Federal agency?

Mr. **Jaffe**. I think Federal agencies are the most immune to political demands for contamination response and cleanup.

Senator BRADLEY. Let me thank both of you very much for your testimony. I found it extremely helpful. Thank you.

Our last panel this morning is Mr. Roger Strelow of General Electric on behalf of the National Environmental Development Association; and Mr. Bruce Leavitt of Consolidation Coal Company on behalf of the American Mining Congress.

Gentlemen, welcome to the committee. If you could, as the clock ticks away, limit your statements to about seven minutes, it would be helpful.

Thank you.

## STATEMENT OF ROGER STRELOW, CHAIRMAN, GROUNDWATER PROJECT, NATIONAL ENVIRONMENTAL DEVELOPMENT ASSOCIATION

Mr. STRELOW. Thank you, Mr. Chairman.

I appreciate this opportunity to testify. My name is Roger Strelow. I am vice president for corporate environmental programs at General Electric; previously served as an assistant administrator at EPA in the Ford Administration.

Today I appear in my capacity as chairman of the National Environmental Development Association's groundwater project. This is a coalition of industrial, agricultural and labor interests, and the NEDA groundwater project specifically represents the mining, food, chemicals, construction, electronics, and petroleum production and refining industries.

We are users of groundwater. Our livelihoods and future growth depend on the continuing availability of groundwater for a wide variety of uses.

Many of our members are also regulated to help protect groundwater. Thus, we believe this gives us a balanced perspective on these issues.

What I would like to do is submit my prepared statement along with our association's policy statement for the record.

Senator BRADLEY. The statement will be placed in the record.

Mr. STRELOW. And perhaps one of the few advantages of playing cleanup in this situation is, I can perhaps be more helpful by trying to respond a little bit to what you heard earlier, deriving those parts of the prepared testimony that bear on that rather than simply reading it.

Senator BRADLEY. That would be a good idea.

Mr. STRELOW. First, on the issue of the need for action and the focus on prevention, the National Research Council, which has been cited here before, in its comprehensive study, confirmed I think what most other investigators have concluded, that there is no present crisis in the situation of the Nation's groundwater, but certainly there are problems, and they are growing, and they are apt to grow unless we all do a much better job at preventing them.

We have a very awesome remedial effort underway under the Superfund program in this country. But I think there is no question that we need a much greater effort at preventing problems, using available preventive measures that are technologically and economically feasible, very much along the lines as the previous witness discussed, the EESI review.

And those preventive measures, I think, should clearly cover all significant sources, not just those that are presently covered. There are other sources that undoubtedly need more attention than they have received to date.

Well, if we need this much greater effort, particularly on the preventive front, why is that we find ourselves in this position of being rather low on the learning curve, perhaps?

I think fundamentally that is because as a Nation we have had very little information on groundwater resources, even where these acquifers are, what their scope and magnitude is, the conditions of these resources, or even information on control techniques.

This, in turn, not surprisingly, reflects a very low level of public investment to date. And in a sense, this is a little ironic. We kind of got into this issue through the backdoor.

We have mounted major efforts at the Federal level to clean up sites under Superfund, to regulate ongoing industrial waste management under RCRA; we have the Safe Drinking Water Act. We have a variety of programs, all of which have a major impact and a positive impact on protecting or remediating groundwater.

But unlike the Clean Air Act, Clean Water Act, we didn't get into the groundwater issue as such, and we now find that we need to fill in some of the gaps.

Well, this then relates to a very important issue, one which has been addressed here at length before, today, on the appropriate roles of Federal and State governments.

We agree very much with virtually every, in fact every broad-based group that I know of that has addressed this issue, the National Groundwater Policy Forum, convened by the Conservation Foundation; the Environmental and Energy Study Institute; the National Research Council have all concluded that there needs to be a very prominent, indeed, leading State role, what the Conservation Foundation report called a "new partnership 'in which the States must play the lead role.

But I think there may be some misconceptions about what many people mean by that. It is not a feeling that the Federal Government ought to be passive, or does not have a role.

I think it is a question of which role can be played most effectively.

First of all, the Federal Government obviously already has, and should have, and should continue, a very major role when you look at Superfund, RCRA, these other programs, that is a very appropriate role that should continue at the Federal level.

But when you look at the additional sources that need some attention, the gaps that need to be filled in the regulatory picture—take the 190,000 empoundments that were cited—it seems equally clear to us that in dealing with those, you are dealing with and get into things like road deicing, septic tanks.

The notion of a centralized Federal program, regulatory program, to deal with those, just does not make sense. So I think the notion of a primary State role in this new expanded partnership reflects the fact that the States need to be doing the frontline regulating of these other sources that need to be brought into the picture.

And of course when you get into land use controls, to the extent that has a role, that has to be at the State or even local level, as has been discussed.

But that brings us back, then, to where I think there is a very legitimate expanded role for the Federal Government, and that is in the area of both finances and information.

Clearly, to develop information on groundwater resources, organizations like the U.S. Geological Survey and EPA I think can do a lot of that much more effectively and efficiently than all the States could trying to do it independently, even though they do need to examine their specific local conditions.

Certainly information on control technologies and strategies, again, can best be developed at the Federal level. There is just a lot in the basic sciences of hydrogeology and understanding groundwater behavior that needs to be better understood. Once again the Federal Government clearly has the most logical role there.

And then providing that information to the States. I think it is only fair to conclude that the lack of action at the State level to date—and there has been a good deal of action; many States have taken leadership efforts and more and more are doing so all the time—but to the extent there has been less than optimum effort by the States, a lot of it is due to the fact that they have virtually no useful information on the subject.

Then you get down to the broader question of finances. And this is a difficult one in the era of Gramm-Rudman and a very proper concern with the Federal budget, it is not easy to just say, well we ought to give more money to the States.

I think there is no question that it is needed, and it really involves a reordering of our priorities. This is what you folks do all the time. EPA within its own budget does that all the time.

I think it basically means that in today's era, we need more attention to groundwater issues. And although it is not easy to cough up a lot of additional money, those resources are clearly needed.

And I think once the States have that, in terms of some grants from the Federal Government, and in terms of the money spent at the Federal level to develop this information, there is every reason to believe that there will be a tremendous amount of action on the part of the States, and we ought not to assume, as I think is implicit in some of the testimony that we have heard today, and that you hear in the general debate on this subject, that somehow the States cannot be trusted to act, that they will be too beholden to local economic interests.

I think if you look at what is going on in the environmental area generally—air, water pollution control, et cetera—that just does not bear out this suspicion.

So we believe that this enhanced Federal financial and information development effort will enable the States to do what they very much need to do to enhance the current efforts.

[The prepared statement of Mr. Strelow follows:]

NEDA
GROUND WATER PROJECT

Roger Strelow, Project Chairman
John Quarles, Vice Chairman and Counsel

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Statement of
Roger Strelow, Chairman
National Environmental Development Association
Ground Water Project

before the

Subcommittee on Water and Power
Committee on Energy and Natural Resources
United States Senate

June 18, 1987

Thank you for the opportunity to testify before the Subcommittee today on the important issues related to this Nation's use of ground water and the need for a new and more effective commitment to the protection of this resource. My name is Roger Strelow and I am Vice President for Corporate Environmental Programs for General Electric. Today I appear in my capacity as chairman of the National Environmental Development Association's Ground Water Project.

NEDA is a coalition of industrial, agricultural and labor interests and the NEDA Ground Water Project represents the mining, food, chemicals, construction, electronics and petroleum production and refining industrial sectors. We are users of ground water. Our livelihoods and our future growth depend on the continuing availability of ground water for a wide variety of uses. Many of our members are also regulated to help protect ground water. We believe this gives us a balanced perspective on these issues.

Our views are presented in some detail in a policy statement which I am submitting for the record. Today I will simply highlight a few critical points.

Summary and Observations

I want to begin by commending the Subcommittee for holding these hearings and for highlighting the need for more information on the quality and quantity of our ground water resources and the need for their protection, and examining the role the federal government can play in that effort.

It is essential that Americans recognize that the federal government is already playing a major role in the protection of ground water:

- EPA's massive Superfund, hazardous waste management (RCRA) and underground storage tank programs are primarily ground water protection and cleanup programs involving the expenditure of billions of federal and industry dollars.

- The Safe Drinking Water Act plays an important role in protecting ground water through the underground injection control, sole source aquifer and new wellhead protection programs that protect public water supplies.

- EPA's pesticide program is paying greater attention to the ground water implications of its registrations.

- USGS and EPA provide invaluable information and research to federal, state and local agencies involved in ground water functions.

Other federal agencies, such as the Office of Surface Mining and Department of Agriculture, also conduct activities that directly or indirectly foster the protection of ground water.

At the same time, the states are beginning to move more aggressively to protect and regulate ground water use and activities that can affect the quantity and quality of ground water available for use in the future. In the West, there is a long tradition of regulation of ground water rights. Now about half the states either have, or are developing, comprehensive programs to protect ground water quality. Some of these programs, particularly the most recently enacted ones, are extraordinarily aggressive.

In light of the federal and state programs in place or coming, and the National Research Council's finding that only a small fraction of the Country's ground water has been degraded, we are not facing a crisis. Nevertheless, serious attention has to be given to the prevention of future contamination and the conservation and preservation of ground water for future use.

The NEDA Ground Water Project, which was formed in 1984, has followed this activity and spent months attempting to identify a proper balance between the federal and state roles. The policy we developed -- which is still in an evolutionary process -- recognizes the federal role in protecting human health and the environment under existing federal laws. It is also clear to the Project's members that the states, whose citizens, communities and businesses use ground water and have current or anticipated problems affecting the resource, should develop their own ground water programs. We also recognize that even the states already committed to programs need assistance.

As our members delved into the problems of ground water contamination, protection and remedial actions, it became clear that ground water is very unlike surface water or air in the degree to which all the relevant factors vary from one site to another, its vulnerability to contamination, the persistence of contamination, how slowly contaminants move and mix in it and the dispersion of those contaminants into locations where they can come into contact with people, plants and animals.

In our research into these issues, we have made a number of observations and reached a number of conclusions. Let me summarize a few of them:

- Ground water protection programs will require a fundamentally different kind of federal-state relationship than under other environmental laws.
- Use is the key element around which all ground water management programs should be designed.
- Federal financial and technical assistance is needed to ensure that the states have the resources they need.

A New Federal/State Relationship Is Needed

Our existing federal environmental laws tend to regulate from a highly centralized structure, treating state and local governments as regulated parties rather than partners. Because of the differences between ground water and air and surface water, a relationship has to be developed in which the federal government supports state action without interfering with a state's ability to tailor its own programs to its needs and conditions.

Ground water aquifers are uniquely characterized by the hydrology and geology and other surface and subsurface conditions of particular locations. These factors and potential contamination problems will differ from place to place, even within the same geographic region. The degree to which ground water is needed in an area and for what uses, its accessibility and abundance and the degree to which it contains natural impurities, also vary widely. Because of the wide range of variation in these factors, no one set of rules, regulations and procedures devised in Washington will be best suited to apply in these differing circumstances. Therefore, programs will need to be primarily developed and administered at the state level and some elements of implementation may need to be carried out at the local level. This argues for a strong state role in the actual regulation and protection of ground water.

This need for genuine state primacy in ground water regulation has been consistently recognized by the broad-based groups that have examined the issue, including the Conservation Foundation's National Groundwater Policy Forum (1987), the Environment and Energy Study Institute (1986) and the National Research Council's Committee on Ground Water Quality Protection (1986). As the Forum's 1987 report stated, "groundwater must be treated differently" than the resources protected by the traditional federal environmental laws. A "new environmental partnership" is needed in which "states must bear the primary responsibility for (groundwater) management." Conservation Foundation, Groundwater Protection, p. 6 (1987).

The federal government should continue to set standards under existing laws to protect public health, such as nationwide drinking water standards. Although the federal government might usefully develop criteria that the states could use to protect other uses of ground water, the setting of standards for those uses should be left to the states. It should be the focal point for the development, collection and dissemination of the information the states will need to do their job of protecting their resources.

## Classification Should Be the Basis of Ground Water Programs

Unlike air and surface water, not all ground water comes into contact with biological systems. Contaminated ground water is a potential and sometimes serious problem when it comes into contact with people, plants or animals. It is when ground water is used -- for drinking water, for agriculture or industrial processes -- that the impurities it carries are of concern. For these reasons, NEDA believes that classification by use should be an important element in state ground water regulatory programs. Classification is already used by many states with advanced, exemplary ground water protection programs, such as my own State of Connecticut. It is viewed as an important tool by the same broad-based groups I cited earlier.

Ground water classification -- by the states and according to the designated or anticipated use of the water -- should be the core of any ground water management program. Some critics of building ground water programs around classification charge that the time and effort required for classification will delay the implementation of ground water protection and remediation measures. However, where real problems have been identified, a state need not wait until a classification system is fully implemented to correct the problems. Conversely, we agree that mapping and classification should proceed in advance of the individual siting and regulatory decisions. Most importantly, the states cannot make rational choices about the need for controls to protect ground water or allocations of resources to protection and remediation measures without classification.

Moreover, NEDA believes that there is a legitimate need for a preventive approach to ground water quality that is based on the application of all available contamination-avoidance measures that are technically and economically feasible. Since not all economic activities can be conducted without any adverse effect on ground water, classification measures can enable states to determine where particular discharge controls or reasonable restrictions on the location of new facilities or activities may be needed, especially in particularly vulnerable areas.

## The States Will Need Financial and Technical Assistance

The single most critical element required for the protection of ground water is adequate resources, both financial and technical. Since the states are responsible for managing their ground water resources, the state legislatures will need to increase the resources available for ground water programs. However, we realize that not all of the states will be able to do an adequate job on their own. Moreover, some work would be more efficiently done at the federal level rather then being repeated by each of the individual states, such as the development of hydrogeological models, the collection of information on remediation techniques, assessment of the effects of contaminants, etc. In short, the federal government should increase substantially the technical and financial assistance it gives to the states.

New federal authority to provide this assistance should contain reasonable criteria to assure that funds are productively used, but should not be conditioned by unnecessarily detailed specifications for the use of the funds that would disrupt ongoing state programs or federal research and development programs. To the degree that Congress specifies any data collection or other research and development programs, it must provide the resources adequate to the new demands. Congress has been quick to mandate new federal programs and new state efforts, but it has not generally allocated resources commensurate with the burdens it has imposed on all levels of government. If this is repeated in the ground water area, the cause of assuring adequate protection of the resource could actually be set back.

## CONCLUSION

Finally, I think the rising public and Congressional concern about ground water contaminations needs to be put in perspective.

Ground water contamination is a serious problem in many areas. Without more informed and, in some places, more aggressive management, the problem will grow. That would be unacceptable. We favor prompt, responsible action, not in a crisis atmosphere -- which would be unwarranted -- but with dedication and, we hope, a strong partnership among the public and private parties concerned. The states (which should bear the primary responsibility outside those programs already administered by the federal government) will need technical and financial assistance to assess their needs and fulfill their responsibilities to the current and future users of ground water. As Congress provides the assistance, it should be melded with the existing federal programs in EPA, USGS and other agencies to supplement these programs without disrupting them. Any federal action should be designed to mesh smoothly with the states' programs as well.

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NEDA
**GROUND WATER PROJECT**

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October 22, 1985

## THE NATIONAL ENVIRONMENTAL DEVELOPMENT ASSOCIATION'S GROUND WATER PROJECT

## STATEMENT OF POLICY AND RECOMMENDATIONS

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## I. Executive Summary

The National Environmental Development Association's Ground Water Project (NEDA/Ground Water) is a coalition of industry, agriculture and labor -- users of ground water as well as members of the regulated community. As such, NEDA/Ground Water believes that ground water management should be a national priority, supported by the federal government, but carried out on a state and local basis.

Contamination of underground water supplies is serious in some areas. However, it is not a nationwide environmental crisis. There is a need for new protective or remedial measures in some areas. The types of problems, their causes and the measures which will best address them differ across the country. For these reasons, the actual design and implementation of ground water protection or mitigation programs should remain primarily the job of the states and local governments. To support the states and local governments, NEDA/Ground Water endorses increased federal technical and financial assistance.

NEDA/Ground Water does not support the passage of federal ground water legislation which would impose goals on the states, dictate how goals are to be reached or impose new federal regulatory requirements.

Because ground water is so unlike other environmental media, it requires different approaches to the control, prevention and remediation of contamination and to its management in general. To design and carry our appropriate and effective ground water management programs, government, business and the public should carefully consider the unique nature of ground water.

NEDA/Ground Water recognizes that in some areas there are threats to ground water which jeopardize its suitability for domestic, agricultural or industrial use. In these cases, the threat may not permit Americans to wait for better knowledge before they act to protect the resource. Our lack of knowledge should, however, caution decisionmakers who would conclude that regulatory programs similar to existing environmental statutes will necessarily provide the right solution.

The goal of ground water programs should be the protection of present or projected uses of aquifers and their recharge areas. Consequently, ground water management programs should;

1. Use appropriate remediation or mitigation measures based on the designated or likely uses of aquifers;
2. Provide better coordination among existing and new protection and remediation programs; and
3. Emphasize state leadership roles.
4. Increase the state resources allocated to the development of ground water-related professional and regulatory capabilities.

Existing state and federal environmental protection and conservation statutes already assign direct and indirect ground water protection and remediation functions to environmental protection, resource conservation and other agencies. At the federal level, the Environmental Protection Agency administers several programs which directly address ground water protection and remediation such as the Safe Drinking Water Act, Superfund and the hazardous waste and underground storage tank provisions of the Resource Conservation and Recovery Act. Beyond the functions already in the province of federal agencies, NEDA/Ground Water recommends that federal involvement should be limited to providing increased technical assistance to states in standard-setting for drinking water, developing methodologies for ground water monitoring and sampling; collecting and disseminating information concerning new technologies for remediation; and providing forums for the resolution of interstate disputes. Congress should assure that such assistance is authorized.

In managing ground water, private and public resources should be allocated in accordance with a rational system of priorities related to the protection of people and ecosystems. In this paper, NEDA/Ground Water recommends consideration of a number of mechanisms for managing ground water.

## II. Introduction

The public and all levels of government are focusing new attention on the need to better protect, conserve, and where needed, clean up this country's ground water supplies. To participate in the public discussion of this issue, the NEDA Ground Water Project has prepared this policy statement and set of recommendations. NEDA/Ground Water is a coalition of industry, agricultural and labor-- users of ground water as well as members of the regulated community. Consequently, this policy reflects a balanced perspective of organizations vitally concerned with the continued availability of ground water for agriculture, industrial and domestic uses, and also concerned about maintaining a healthy national climate for economic development.

Our recommendations are intended to reflect the unique nature of ground water as an environmental medium, the many types of aquifers and the various uses for which ground water is needed. They are also intended to provide a framework for the most effective and efficient mix of regulatory and non-regulatory management techniques built on the existing foundation of federal, state, and local responsibilities.

This paper is intended to be an initial statement of principles to guide the future work of the Project. Detailed recommendations on the issues raised in this policy statement and more detailed discussions of the technical and policy underpinnings of those recommendations will follow.

## III. Overview

Although ground water contamination* should not be characterized as a nationwide crisis, it is a serious problem in some places. To protect or restore ground water for the many uses for which it is needed, NEDA/Ground Water supports a new committment to improved and more effectively coordinated approaches to the management of ground water resources at all levels of government. These new efforts should build upon, rather than replace or duplicate the existing structure of federal, state and local laws and regulations. Additional technical and financial resources should be allocated to ground water protection and remediation and, where necessary, existing laws may have to be amended in order to assure that the designated or intended uses of ground water are protected,

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* To avoid confusion between naturally-occurring impurities often found in ground water and substances introduced by man, as used in this paper, "contamination" means the presence of pollutants introduced by human activity into an aquifer such that current or likely future uses are impaired. "Pollutant" or "pollution" includes both naturally-occurring substances and those introduced by man.

Ground water management has long been the primary responsibility of the states. NEDA/Ground Water supports the continuation, improvement and expansion of the states' traditional programs for ground water protection and remediation including classification, regulation of discharges, standards-setting, etc. Nevertheless, these programs have not been adequate in some places. The Ground Water Project believes this has been more the result of a lack of resources than a lack of will and that this situation can be improved if, as we recommend, both state and federal resources for ground water management are increased.

The public and decision makers need to be provided with information to better understand the unique nature of ground water as an environmental medium in order to structure more effective management programs. Further, increased public knowledge about the importance of ground water and the threats to it will bring increased public support for ground water management programs.

Efforts are needed not only to increase understanding of the threats to ground water and what can be done to address those threats, but also to enhance understanding of the resource itself. Without data to the contrary, there is a tendency to think of ground water management in terms derived from more familiar media -- surface water and air. There are, however, fundamental differences between ground water and these other media.

Ground water is found throughout the 50 states. Its quality, availability, quantity and usefulness varies greatly from region to region. Some ground water is fresh water, and can accommodate almost any use including drinking water. However, much of it is saline or contains concentrations of dissolved solids or other impurities that occur naturally. Depending on the nature and concentrations of these materials, and irrespective of human impacts on an aquifer, ground water may, therefore, be unsuitable for any use. In other cases, ground water may be too impure for drinking, but of high enough quality for some agricultural or industrial uses.

Ground water is found in saturated subsurface formations of different types of rock, sand or gravel at depths ranging from a few feet to thousands of feet below the surface. The formations containing water may be insulated from higher or lower subsurface layers or the surface by rock, clay, or other materials that prevent or limit the exchange of fluids among the water-bearing layers, other formations and the surface. These factors affect the natural quality of the water in an aquifer, its susceptibility to contamination and its availability for use.

Generally, ground water travels through aquifers very slowly and much of it reaches the surface only when purposely withdraw for use. These factors limit the mobility of any pollutants (natural or introduced by man) in ground water and the potential for people, animals and vegetation to be exposed, except when the water is withdrawn for use.

Consequently, ground water contamination is, more often than not, a localized problem that does not cross state lines. Although aquifers themselves may span several states, areas of contamination and the sources of that contamination are far less likely to present interstate issues than air and surface water pollution.

Finally, ground water is a medium in which pollutants (whether introduced by man or nature) are far more restricted in their movement than in surface water or the air, and to which people and the environment are generally exposed only as a function of the use which the water is or may be applied. These differences between ground water and other media, and the tremendous variety in the type and quality of aquifers and ground water uses, all have direct bearing on what measures are best to manage the resource and where decisions on management are best made.

## IV. Recommendations

### Recommendation 1: GROUND WATER MANAGEMENT GOALS

The goal of ground water management programs should be the protection of present or projected uses of aquifers and their recharge areas and the use of appropriate remediation or mitigation measures where contamination has occurred.

### Discussion.

Because of the unique nature of ground water as a resource and an environmental medium, different management approaches are needed from those used for the protection of air and surface waters. As discussed below, "management" strategies should be based on these unique characteristics. In particular, the ground water remediation and mitigation measures should address risks to biological receptors -- people, animals or plants that would come in contact with contaminants in the water, rather than water qualify *per se*.

The protection of human health and the environment would be best accomplished through coordinated management programs which contain regulatory and non-regulatory elements selected on the basis of the characteristics of individual aquifers, or portions of aquifers: their designated uses, location, susceptibility to contamination and the quality and quantity of water they contain.

### Recommendation 2: EDUCATION ABOUT GROUND WATER

Government and private sector decision makers and the general public need to be provided with better information to improve understanding of the unique nature of this resource and the threats to it.

Discussion.

Ground water is a unique, less familiar and less understood resource than other environmental medium. The factors which make it different also require management techniques which reflect its special character. Because of this combination of uniqueness and unfamiliarity and the need to develop special management techniques, education should be given a high priority in the development of national ground water policy. In particular information needs to be developed and effectively communicated on the following points:

A. Nature of the Resource. Government, business, and the public need to fully appreciate the unique nature of ground water in order to manage the resource. Although the sources of technical information and analytical techniques may be centralized, a great deal of site-specific decision making is required because every aquifer has unique characteristics which affect the need for, and suitability of, different management techniques. This mean that more knowledgeable decision makers, supported by more knowledgeable constituents, are needed around the country.

B. Nature of the Problem. Although human contamination of ground water is a major problem in some areas, the public and governments at all levels must recognize that not all ground water is suitable for use, even in its natural state. Where there is past or potential contamination attributable to human activity, the priority given to prevention or remediation, the methods and levels selected for control or cleanup and the specific management techniques chosen should all reflect knowledge of local conditions and needs.

C. Sources of Contamination. In order to control, prevent, or remediate human contamination of ground water, knowledge about the sources of contamination and their relative contributions to the overall problem is required. Ground water contamination comes from a wide range of human activities: municipal waste disposal, industry, agriculture, urban street runoff, the use of highway de-icing salts, etc. In addition, in some areas the cumulative effect of many individual small sources of contamination (such as residential septic tanks) may be greater than the impacts of major sources of contamination.

Ground water management programs must address all significant, or potentially significant, sources of contamination in a region. Failure to address the problem in such a comprehensive way will result in failure to protect the resource. However, which categories of sources are the most significant sources of contamination varies from one location to another.

D. Priorities. To obtain the greatest, most timely, benefits possible, the private and public resources to be used in ground water protection and remediation should be allocated in accordance with a rational system of priorities related to the protection of people and ecosystems. NEDA/Ground Water believes that priorities should be based on the potential for people, animals or vegetation to be exposed to contaminants in ground water. In most cases, the potential for exposure will be a function of the suitability of the water in an aquifer for some use and the likelihood of such use.

## Recommendation 3: MANAGEMENT

A. General.

Ground water management programs should:

- Be based on the designated or likely uses of aquifers or segments of aquifers;
- Provide better coordination among existing and new protection and remediation programs;
- Emphasize the states' leadership role in the operation of ground water programs.

### Discussion.

Ground water management approaches based on the intended or designated uses of aquifers best reflect the unique characteristics of this resource and the ways in which ground water contamination presents health or environmental risks. Such approaches consequently hold the greatest promise for allocating resources to best reduce or prevent such risks.

Numerous laws at the federal, state and local levels directly and indirectly address the issue of ground water contamination. Because the factors relevant to the selection of ground water management techniques tend to be localized, states are the most appropriate level of government to develop and administer ground water management programs. Nevertheless, as governments at all levels address their ground water responsibilities, they should look to improving coordination among the existing programs and to assuring that any new programs are well coordinated.

Programs should be designed so that, to the maximum degree possible, resources are expended in ways which most directly and efficiently achieve the goals of ground water management.

B. Use Classification and Inventory. In order to design programs based on ground water use, use classification, keyed to the point of use, is required. This in turn requires the development of better inventories of available ground water supplies, their quality, recharge areas, susceptibility to contamination, and present and projected uses, in addition to surveys of sources of actual potential contamination.

Discussion

Although comprehensive use classification efforts need not precede all actions to protect or remediate ground wate supplies, such efforts should be a major focus of any ground water management program. Without such an effort, long-term protection and clean-up efforts will inevitably have to rely on goals expressed as ambient targets which do not relate well to the actual potential for exposure to people or other biological receptors. Since the potential for exposure is a function of use, better inventories of ground water resources and their uses are needed and should generally be integrated into classification systems.

Classification should not be over-simplified. If classification systems group together uses with widely-varying tolerances for impurities in ground water, resources available for protective programs and remediation will be misallocated.

Once ground water resources are classified, standards for remediation and protection of the resources tied to those uses can be set. These standards should be based on the application of the best available scientific and technical data. Standards borrowed from other programs can be used when relevant to the human exposures or environmental releases associated with an aquifer, or the portion of an aquifer in question.

Because use, and the likelihood and type of exposure, often vary widely for a particular aquifer, the standards should be tied to the point of use.

c. Program Management Elements. Based on local needs, ground water management programs should be comprehensive and should include those of the following elements which promise to provide the greatest benefit:

- Uniform national criteria for ground water used, or likely to be used, as drinking water;
- Aquifer classification procedures and criteria for other uses;
- Use designation procedures and criteria tied to the point of use;
- Controls on point and non-point sources through discharge limits, permitting requirements and best management practices.
- Special controls over critical aquifers and recharge zones;
- Adequate enforcement mechanisms.

The elements needed in a ground water management program will depend on the uses for which an aquifer's water is withdrawn, or is likely to be needed, and the types of sources which threaten to impair those uses.

D. Remediation. Decisions about cleanup and mitigation of ground water contamination should be directed at restoring ground water to suitability for its designated or intended uses. The issue of "how clean is clean?" should be addressed on a case-by-case basis with reference to the best available scientific knowledge and currently available technological options for remediation.

Discussion.

Major factors in clean-up decisions should include:

- The present or intended future use of a particular aquifer (taking into account naturally-occurring impurities which limit use);
- The extent to which ground water has been degraded beyond the relevant use standard;
- The economic and technical feasibility of removing the contamination;
- The feasibility of controlling or eliminating the source of contamination; and
- The availability of other water supplies for the same intended use.

Where ground water contamination impairs or threatens to impair designed or intended uses, appropriate action must be taken to supply current users with water of a quality suitable for use and to assure to the extend practicable, that the resource will be available for future users. Containment of the contamination or providing alternative water supplies or surface treatment of ground water supply should be considered as options to mitigate the effect of contamination. Where these strategies are not sufficient to assure the adequacy of present and future water supplies for the uses in question, clean-up of the impacted aquifer should be considered.

E. State and Federal Management Roles. The states should retain primary responsibility for managing ground water resources since ground water protection issues are generally defined by localized parameters and conditions.

Discussion.

Factors that impact on ground water such as geography, geology, hydrogeology, climate, industrial and agricultural activities, and population vary from state to state. Ground water contamination sources differ among, and even within, region. In addition, states have different needs for their ground water, different requirements for protection based on these needs, and different ground water quality. For these reasons, the primary responsibility for designing and carrying out the elements of ground water management programs, discussed above, should remain with the states and local governments. The federal government can play an important supportive role to provide the necessary technical and financial underpinnings for the state and local programs.

Federal involvement in the management and protection of ground water should provide:

- Standards-setting for drinking water;
- Ground water remediation under existing federal laws;
- Criteria for the development of ground water standard for designated domestic and other industrial and irrigation uses;
- Assistance with the evaluation and characterization of ground water resources;
- Methodologies for ground water monitoring, sampling, modeling and clean-up;
- Assistance in the identification of control technology and clean up technology applications to ground water management;
- Arbitration of interstate disputes concerning ground water quality or withdrawal.

A supportive federal role is necessary because of the complexities of ground water contamination and remediation, the sophisticated technical resources and expertise in federal agencies which many states do not have, and data which the Federal Government has or could obtain more efficiently than the states. An appropriate federal role would include providing technical assistance to states on safe levels of contaminants for certain uses and providing technical assistance on ground water monitoring, sampling and on laboratory and analytical techniques.

With regard to ground water management, the Federal Government can provide much needed technical and fiscal assistance to states while leaving regulatory matters and site-specific ground water protection issues to states and local governments where they can be most appropriately addressed.

Recommendation #4: NEED FOR FEDERAL LEGISLATION

Increased federal assistance to the states is needed:

- To support the development and implementation of ground water classification systems;
- To provide the technical information needed for ground water management decisions; and
- To coordinate existing federal, state and local laws.

Congress should assure that such assistance is authorized and encourage coordination among programs.

Comprehensive ground water legislation imposing new federal regulatory requirements on states or individual sources is not recommended at this time.

Discussion.

Much of what NEDA/Ground Water is advocating would place additional fiscal and technical demands on state and local governments. The federal government could best support the development of technically sound and effective ground water management programs by providing support to the states' efforts through grants, the collection of data and the provision of technical support.

Federal involvement should also be designed to avoid duplication of effort among the states in the collection and analysis of data on ground water quality and availability and in the development and evaluation of techniques for assessing, controlling and remediating ground water contamination.

To the degree there are gaps in existing regulatory authorities to accomplish the ground water management goals discussed above, new legislation should be enacted at the state level so that it can be tailored to the regulatory structures in individual states, to the condition of the ground water in that state and to the uses to which the ground water is, or is likely to be applied.

NEDA
GROUND WATER PROJECT

Roger Strelow, Project Chairman
John Quarles, Vice Chairman and Counsel

National Environmental Development Association • 1440 New York Avenue, NW, Washington D C 20005 • (202) 638-1230

## THE NATIONAL ENVIRONMENTAL DEVELOPMENT ASSOCIATION'S

## GROUND WATER PROJECT

The National Environmental Development Association (NEDA) is a coalition of industry, labor and agricultural concerns dedicated to reconciling America's economic and environmental goals. Some of NEDA's programs are conducted through special projects to which members participate separately, but which all operate under the NEDA umbrella.

In response to the growing national debate over ground water policy issues, the NEDA Ground Water Project was created to present a balanced and constructive perspective on appropriate approaches to ensuring the continued availability of ground water for agriculture, industrial and domestic uses. Since its inception in 1985, the Ground Water Project -- whose membership includes users of ground water as well as those subject to regulation -- has addressed both regulatory and legislative issues related to ground water policy. The Projects membership includes:

Anheuser-Busch Companies
Buildings, Construction and Trades
  Department, AFL-CIO
Campbell Soup Company
Chevron, USA
Consolidation Coal Company
Dow Chemical Company
FMC Corporation
General Electric Company
IBM Corporation
Kaiser Aluminum and
  Chemical Corporation
Laborers' International Union
  of North America
Mobil Oil Corporation
Monsanto Company
Occidental Petroleum
Phillips Petroleum
Standard Oil Company
Sun Company

Contact NEDA offices at (202) 638-1230 for more information about NEDA or the Ground Water Project.

## STATEMENT OF BRUCE R. LEAVITT, HYDROGEOLOGIST, CONSOLIDATION COAL CO., ON BEHALF OF THE AMERICAN MINING CONGRESS

Mr. **Leavitt**. Thank you, Mr. Chairman.

My name is Bruce Leavitt, and I am a hydrogeologist with the environmental quality control department of Conslidation Coal Company.

I am also chairman of the American Mining Congress groundwater task force. The American Mining Congress is a National association of producers of most of the Nation's supply of metals, coal and industrial and agricultural minerals; manufacturers of mining equipment; and financial and engineering firms that service the mining industry.

AMC appreciates this opportunity to discuss the importance of groundwater management from the perspective of the minerals industry.

At the outset, I would like to state that wise groundwater management is vital to the health of our citizens and of our economy.

Groundwater and minerals are two of the most important natural resources of this Nation. Groundwater provides drinking water for millions of people, and water for crop irrigation and livestock watering.

It is used in many commercial operations and industrial processes.

Minerals are also an integral part of our society. Mining and groundwater are inextricably intertwined. The extractive process of mining occurs above, within or below acquifers.

Consequently, mining cannot occur without affecting groundwater to some degree. The very act of mining changes the groundwater system around the mine.

The most obvious effect is that groundwater flows into the mine. This cause changes in the level of groundwater in the acquifer.

Mining also breaks up the rocks containing the minerals. Fresh rock surfaces are exposed to the weathering process. Groundwater passing over this broken rock can dissolve components of the rock as well as the weathering process.

This causes changes in the natural water chemistry.

These consequences of mining are unavoidable. We cannot prevent groundwater from entering the mine, nor can we prevent the dissolution of soluble components.

This may limit the use of groundwater in and around the mine. Clearly, we must minimize our impacts to groundwater. But just as clearly, this Nation cannot exist as we know it without mining.

Mining is not the only beneficial activity in our society that has an unavoidable impact on groundwater. Septic tanks, use of fertilizers, highway deicing compounds; other basic activities, such as construction and forestry, have also been documented as contributing to groundwater contamination.

Recognizing the importance of these basic activities, mineral resources, and groundwater, has led the American Mining Congress to advocate a realistic approach to groundwater protection.

The basic tenets of the approach consist of managing groundwater for the maximum benefit of society, given its multiple beneficial uses; providing Federal assistance to the States in the form of research and financial backing; and assisting States in their role as managers of groundwater.

I would like to say a word or two about each of these.

Groundwater and minerals are both important resources. One cannot be protected to the exclusion of the other. If we are to maintain ourselves as a society, we must learn to balance our extraction of the needed minerals while guarding the biosphere that makes our lives possible.

The American Mining Industry is committed to striking that balance. Groundwater must be managed for all of society's needs, now and in the future.

The American Mining Congress is concerned with any regulatory approach that would limit groundwater to one use to the exclusion of others.

Specifically, if we limit groundwater use strictly for drinking water and nothing else, then we do so to the detriment, if not the outright elimination, of many necessary human activities.

AMC is unalterably opposed to nondegradation as a means of achieving groundwater protection. Nondegradation is an unworkable concept, because it is impossible to conduct basic human activities without adding contaminants, to some degree, to groundwater.

For many reasons, States should decide who best to manage their groundwater. One principal reason is, the groundwater quality cannot be protected without consideration of groundwater quantity.

The control of groundwater quantity and quality meet at the State level, where the ability and flexibility to manage the resource become focused.

Here, consideration can be given to such factors as drinking water needs, water rights, hydrogeology, past and future land use, and economic development.

Indiscriminate disposal by individuals of waste or used products can cause contamination. Federal regulation cannot cope with groundwater contamination at this level.

Therefore, AMC supports broad based public education about groundwater.

The appropriate role of the Federal Government is to support groundwater program development at the State level, both technically and financially, and to utilize State programs when implementing the Federal laws that affect groundwater.

Technical assistance includes the determination and mapping of groundwater boundaries, acquifer boundaries; yield, quality, acquifer vulnerability, and recharge and discharge areas.

The U.S. Geological Survey has the experience and the expertise to provide this assistance.

The Environmental Protection Agency also has a role in groundwater protection. We believe that EPA should continue to determine the health effects of contaminants, including relative risk; investigate the fate and transport of contaminants; and provide public education about groundwater, of what individuals should do to protect it.

In conclusion, the American Mining Congress supports the management of groundwater resources for all of society's needs, now and in the future.

Simplistic concepts such as nondegradation or inflexible regulations only serve to obscure the real work that needs to be done.

Because of the diversity of the resource and its utilization, States are best suited to manage the groundwater resource.

Research is needed to define the resource, as well as to find ways to minimize man's impact on it. The most appropriate role for the Federal Government is to provide technical and financial assistance to the States, and let the States determine how best to protect their groundwater.

[The prepared statement of Mr. Leavitt follows:]

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Statement of

**BRUCE R. LEAVITT**
**Hydrogeologist**
**Consolidation Coal Company**

on behalf of the

AMERICAN MINING CONGRESS

before the

Subcommittee on Water and Power

of the

Committee on Energy and Natural Resources

United States Senate

Hearing on

GROUND-WATER PROTECTION

June 18, 1987

Mr. Chairman and Members of the Committee. I am Bruce R. Leavitt, a hydrogeologist with the Environmental Quality Control Department of Consolidation Coal Company, and chairman of the American Mining Congress (AMC) Ground-Water Task Force. AMC is a national association of producers of most of the nation's supply of metals, coal and industrial and agricultural minerals, manufacturers of mining equipment and financial and engineering firms that serve the mining industry.

AMC appreciates this opportunity to discuss the importance of ground-water management from the perspective of the minerals industry. Wise ground-water management is vital to the health of our citizens and our economy.

Ground water and minerals are two of the most important natural resources of this Nation. Ground water provides drinking water for millions of Americans, and water for crop irrigation and livestock. It is used in many commercial operations and industrial processes.

Minerals are also an integral part of our society. Our homes, schools, office buildings, automobiles, and household appliances are composed of minerals once mined from the ground. Most of the electricity that provides the light and heat for our houses and work places is generated by the use of fuel minerals. The basic components of our communications networks and defense systems rely on products made of minerals.

In order to understand our industry's position on the complex ground-water issues facing the nation, an understanding of the interrelationship of mining and ground water is necessary.

Mining and ground water are inextricably intertwined. The extractive process of mining occurs above, within, or below aquifers. Consequently, mining cannot occur without affecting ground water to some degree.

The very act of mining changes the ground-water system around the mine. The most obvious effect is that ground water flows into the mine. This causes changes in the level of ground water in the aquifer. Mining also breaks up the rocks containing the minerals. Fresh rock surfaces are exposed to the weathering process. Ground water passing over this broken rock can dissolve components of the rock as well as any weathering products. This causes changes in the natural water chemistry. Because mining occurs in areas where ore minerals are abundant, it is not unusual to find elevated concentrations of these chemicals in the naturally occurring ground water and mine water.

These consequences of mining are unavoidable. We cannot prevent ground water from entering the mine nor can we prevent the dissolution of soluble components of the rock. This may limit the use of the ground water in and around a mine. Clearly we must minimize our impacts to ground water, but just as clearly, this nation cannot exist, as we know it, without mining.

Mining is not the only beneficial activity in our society that has an unavoidable impact on ground water. Septic tanks represent the single largest contribution of contaminants to ground water. The use of fertilizers has caused ground-water contamination in a number of states while providing food supplies and other important agricultural commodities. Highway deicing compounds find their way into the ground water after they have been used to reduce hazardous conditions on our nation's highways. Other basic activities such as construction and forestry have also been documented as contributing to ground-water contamination.

Recognizing the importance of these basic activities, mineral resources, and ground water, has led AMC to advocate a realistic approach to ground-water protection. The basic tenets of the approach consist of managing ground water for the maximum benefit of society given its multiple beneficial uses, providing federal assistance to the states in the form of research and financial backing and assisting states in their role as primary managers of ground water. I wish to say a word or two about each of these aspects.

As I stated earlier, ground water and minerals are both important resources. One cannot be protected to the exclusion of the other. If we are to maintain ourselves as a society, we must learn to balance the extraction of the earth's needed minerals while guarding the biosphere that makes our lives possible. The American mining industry is committed to striking that balance

Ground water must be managed for all of society's needs, now and in the future. AMC is concerned with any regulatory approach that would limit ground water to one use to the exclusion of others. Specifically, if we limit ground-water use strictly for drinking water and nothing else, then we do so to the detriment, if not the outright elimination, of many necessary human activities.

A recognition that many of man's activities will inevitably have some impact on water quality implies that some approaches to ground-water protection are self defeating. AMC is unalterably opposed to nondegradation as a means of achieving ground-water protection. Nondegradation is an unworkable concept because it is impossible to conduct basic human activities without adding contaminants in some degree to ground water. Even the proponents of nondegradation admit that it is unachieveable. Use of the term creates confusion and misunderstanding. Simply redefining nondegradation to mean something else does not protect ground water, and one has to question if this approach is being honest with the American people. Rather than redefining terms, it is better to recognize the technical realities and manage the ground-water resource to accommodate competing beneficial uses.

For many reasons states should decide how best to manage their ground water. One principal reason is that ground-water quality cannot be protected without consideration of ground-water quantity. Excessive pumping of ground water can cause salt water intrusion in some areas. Similarly, ground-water extraction can promote or retard contaminant migration.

The control of ground-water quantity and quality meets at the state level, where the ability and flexibility to manage the resource become focused. Here consideration can be given to such factors as drinking water needs, water rights, hydrogeology, past and future land use, and economic development.

States have a long history of managing ground-water quantity, and are developing programs for ground-water quality protection. As of 1985, EPA reported that 46 of the states either had or were developing ground-water protection policies.

Public education is a major factor in effective ground-water protection. Indiscriminate disposal by individuals of waste or used products can cause contamination. Federal regulation cannot cope with ground-water contamination at this level. Therefore, AMC supports broad-based public education about ground water. These programs should be developed by the states or non-profit organizations.

The appropriate role of the federal government is to support ground-water program development at the state level both technically and financially and to utilize state programs when implementing the federal laws that affect ground water. Technical assistance includes the determination and mapping of aquifer boundaries, yield, quality, aquifer vulnerability, and recharge and discharge areas. The U.S. Geological Survey has the expertise and the experience to provide this assistance.

The Environmental Protection Agency also has a role in ground-water protection. We believe that EPA should continue to determine the health effects of contaminants, including relative risk assessment, investigate the fate and transport of contaminants, and provide public education about ground water and what individuals should do to protect it.

In conclusion, the American Mining Congress supports the management of ground-water resources for all of society's needs, now and in the future. Simplistic concepts such as non-degradation or inflexible regulations only serve to obscure the real work that needs to be done. Because of the diversity of the resource and its utilization, states are best suited to manage the ground-water resource. Research is needed to define the resource as well as to find ways to minimize man's impact on it. The most appropriate role for the federal government is to provide technical and financial support to the states and then let the states determine how best to protect their ground water.

Senator **Bradley**. Thank you very much, Mr. Leavitt.

Mr. Strelow, do we need a statute to consolidate or coordinate existing Federal laws relating to groundwater?

Mr. **Strelow**. Mr. Chairman, I think that is a subject that should be carefully considered. I do not know that there is a clear answer at this point.

For example, the administrator of EPA has certainly suggested that he would favor the possibility of some Federal legislation simply to ensure consistency among the standards applicable to groundwater at the Federal level.

And I think that is something that, if there is to be legislation, that is a subject that will have to be addressed. Otherwise, it will have to be addressed as each of these several statutes is reauthorized periodically, which in fact may be a less efficient way to do it.

But there is a danger that right now, at the Federal level itself, we may not have a totally clear and consistent approach to the manner in which we regulate groundwater.

Senator **Bradley**. Both of you have stated very strongly that you want to have States in control of the whole groundwater issue.

What about the question of States that share acquifers, and one State is doing a pretty good job and the other State is not doing a very good job at all?

Mr. **Strelow**. At the moment those kinds of disputes I think would have to be resolved in the courts if there was an inability to do it between the two States.

In my own view, I would support and have previously testified that I would support, if there is to be additional Federal groundwater legislation, some type of let's call it an arbitration mechanism whereby EPA could be called in if there really was an impasse between two or more States as to a shared resource, or impacts from one affecting another.

I think in our experience so far there are very few instances of that. I would not expect that to be a frequent problem, but neither do I think it should just be left unattended. I think that would be an appropriate, limited role for the Federal Government.

Mr. **Leavitt**. Mr. Chairman, from a technical standpoint, the impact of one State's impact on another is always going to be extremely limited. Groundwater does not move very quickly. It normally does not move very far.

EPA's recent technical guidance document on acquifer classification indicated that some of the longest plumes that they have seen from contamination sources are on the order of a couple of miles.

Consequently, I do not think that the effect of one acquifer on another State is going to be a very significant problem.

Senator **Bradley**. Who pays for the monitoring of the plume?

Mr. **Leavitt**. It depends on the source at this time. If it is a superfund site——

Senator **Bradley**. Say it is not.

Mr. **Leavitt**. Generally, we expect that the person who is responsible for the contamination should be involved in the monitoring of that.

Mr. **Strelow**. That is typically what happens, if a State or a private party discovers apparent contamination or suspects it, the source is usually directed to undertake appropriate monitoring.

Senator **Bradley**. Okay, let me thank you both for your testimony. Let me thank all of the witnesses today for their testimony as we start to build a record on groundwater issues and hopefully we will move from groundwater to surface water later in the year.

There will be some field hearings on the groundwater question. The record is open, and we solicit any additional views that anyone might have concerning the issues today.

I think that although there appeared to be some disagreement and there is some disagreement, I find this kind of process helpful, because it frames the issue and the choices that the committee and the Congress will have to make.

Thank you very much for your participation today, and the subcommittee is adjourned.

[Whereupon, at 12 p.m. the subcommittee adjourned.]

# APPENDIX

## ADDITIONAL MATERIAL SUBMITTED FOR THE RECORD

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Georgia Department of Natural Resources

205 Butler Street, S.E., Suite 1252, Atlanta, Georgia 30334
J. Leonard Ledbetter, Commissioner
404/656-3500

July 31, 1987

Honorable Bill Bradley
Chairman
Subcommittee on Water and Power
Committee on Energy and Natural Resources
Dirksen Senate Office Building, Room SD-306
Washington, D. C. 20510

AUG 06 1987

Dear Senator Bradley:

We recently learned of testimony given by Mr. Erik D. Olson of the National Wildlife Federation before the Subcommittee on Water and Power of the Committee on Energy and Natural Resources regarding ground-water programs of the United States Geological Survey (USGS) and the Environmental Protection Agency (EPA). In his testimony, Mr. Olson incorrectly indicated that the State of Georgia had not been aggressively protecting the State ground-water resources.

Apparently Mr. Olson's information was not accurate with regard to Georgia; rather Georgia consistently has been in the forefront of ground-water protection. For example:

(1) Georgia was the first southeastern state as well as one of the first states nationwide to implement a comprehensive statewide ground-water protection plan. Georgia's management plan was implemented in 1983, well in advance of EPA's strategy. EPA has commonly requested copies of Georgia's plan to give to other states as an "example" of a good program.

(2) To date, Georgia has only had to abandon one public drinking water well due to chemical pollution. This, we believe, is a very enviable record that speaks to the effectiveness of our program.

(3) Data gathering, analysis and technical investigations performed by Georgia's scientists extend back to the turn of the century. Technical programs of work, developed under Georgia's direction are used as benchmark studies throughout the nation. Several programs, such as our Water Use Program, are the standard upon which other states are directed to use as a model. Professionals at both the USGS and EPA commonly remark that Georgia is several years ahead of most states in the development and implementation of its ground-water program.

(4) Georgia was the first state in the country to initiate development of a state-wide recharge/discharge area protection plan.

(5) Georgia has one of the largest and most technically complex ground-water monitoring well networks in the entire country. Our network of several thousand wells is capable of monitoring water quality as well as water availability. Several of the salt-water monitoring wells along the coast are among the deepest in the world.

(6) Georgia was the first state to be fully authorized by EPA to regulate hazardous wastes as part of RCRA. Georgia's overall hazardous waste management program, which has ground-water protection as its highest priority, has been recognized by EPA and professional organizations such as ASIWPCA as being the most outstanding program in the southeast.

(7) Georgia has successfully regulated ground-water withdrawals and ground-water quality and quantity for the past fifteen years under its Ground-Water Use Act. Georgia also has a Water Well Standards Act by which all wells and boreholes must meet strict construction criteria to prevent pollution.

(8) Georgia is fully authorized by EPA to administer the UIC program. Unlike most states, Georgia has taken a very strict position in that the State will not permit the underground injection of wastes.

Mr. Olson also indicates that several other states, including Connecticut, New Jersey, Wisconsin, and Iowa are very active. Mr. Olson, however, did not point out that Georgia's joint-funding program with the USGS (a measure of a state's water resources program) exceeds that of Connecticut, Wisconsin and Iowa. Moreover, the major drinking water aquifers of Georgia are naturally protected from pollution; whereas, the geologic conditions in Connecticut, New Jersey, Wisconsin and Iowa offer little natural protection; thus the aquifers of these states are more susceptible to pollution. Because of the complexity of the hydrogeologic regime, comparisons between state ground-water programs easily can be misconstrued.

In summary, while we do not know the source of the National Wildlife Federation's survey, their information can in no way be considered as factual regarding the State of Georgia.

Sincerely,

J Leonard Ledbetter

J. Leonard Ledbetter
Commissioner

JLL:wmb
cc: Honorable Wyche Fowler Jr.
Members of the Subcommittee on
Water and Power
Erik D. Olson

**Western Regional Council**

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August 4, 1987

The Honorable Bill Bradley, Chairman
Subcommittee on Water and Power
306 Dirksen Senate Office Building
Washington, D.C. 200510-6150

Dear Senator Bradley:

The Western Regional Council is very interested in the issues surrounding groundwater quality and protection. Groundwater in our region has many unique factors and characteristics. We are most concerned that Congress recognize and understand these factors and address our concerns during consideration of groundwater proposals and legislation.

We hope your recent hearings on the issues provided valuable information and insights in the ongoing debate on the proper method of addressing groundwater protection and management. We appreciate the invitation of your staff to submit our views. Pursuant to that request, enclosed is a brief Western Regional Council position statement. We hope to have the opportunity, in the future, to provide more detailed information and analysis in support of our position.

Thank you, again, for the opportunity to provide input into the groundwater discussion.

Sincerely,

Austin W. Stedham

Austin W. Stedham, Chairman
Groundwater ad hoc Committee

:ca51P

Enclosure

P.O. Box 8144, Salt Lake City, Utah 84108 · Telephone (801) 363-7997

# Western Regional Council

## POSITION STATEMENT
## ON
## GROUNDWATER

The Western Regional Council recognizes that the management and protection of our nation's groundwater is important. The WRC, however, does not believe legislation creating a comprehensive federal groundwater regulatory program is necessary or appropriate.

The basic responsibility and authority for groundwater management should remain with the states. In the West, water has long been managed as a critical, scarce, and carefully allocated resource, and states have water management laws already in place. These laws address both surface and groundwater quantity and quality. Because of increasing water demand for development and quality drinking water, western states have been active and innovative by expanding and implementing groundwater management programs.

Such factors as geography, climate, demographics, geology, hydrology and water rights separate the West from other regions of the country. States can better establish regulations taking into consideration the unique aspects of each state. Interstate conflicts are best addressed through interstate compacts.

Should the Congress consider groundwater legislation, the federal role defined by such legislation should be limited to funding, technical assistance and authority for state management of Indian and federal lands and facilities. The Congress should not attempt to impose artificial uniformity by establishing national standards and mandatory aquifer classification systems.

STATE OF FLORIDA
**DEPARTMENT OF ENVIRONMENTAL REGULATION**

TWIN TOWERS OFFICE BUILDING
2600 BLAIR STONE ROAD
TALLAHASSEE, FLORIDA 32399-2400

BOB MARTINEZ
GOVERNOR

DALE TWACHTMANN
SECRETARY

June 29, 1987

Honorable Bill Bradley
United States Senate
Subcommittee on Water and Power
Washington, D.C. 20510-6150

Dear Senator Bradley:

Thank you for the invitation to testify before your Subcommittee on Water and Power regarding the ground water issue. Below is a written version of what I would have presented to the subcommittee had I been able to attend the hearing in person. The focus of my comments is on the need for a Congressional Ground Water Act which provides for federal leadership, funding and technical assistance but places the primary responsibility for program implementation with the states. The comments also stress the need for retaining the federal responsibility for administering the Act within EPA, but expanding the roles of the USGS and the USDA in the areas of research and development. Finally, I invite your attention to and support of the current Senate bills S.1105 and S.20 which collectively embody the sentiments expressed in my comments.

I should point out that because of time constraints for delivering these comments, I was unable to obtain the official approval of the comments by the state's administration. As such, the comments do not necessarily represent Florida's official position on the issue of ground water protection. Rather they should be viewed as representing my own views based on my nine years of experience as the ground water program manager for our state.

Thank you for giving me the opportunity to testify. If I can be of further help, please do not hesitate to contact me.

Sincerely,

Rodney S. DeHan

Rodney S. DeHan, Ph.D.
Assistant Bureau Chief

RSD/ek
Enclosure

*Protecting Florida and Your Quality of Life*

In the seventies we debated the existence and severity of the ground water pollution problem. In the eighties we are faced with finding solutions to a problem that is no longer a subject for debate.

I will restrict my comments to the subject of the federal role and discuss the issue from the vantage point of a state program manager.

It has been said by those advocating a minimum federal role that most, if not all, of the states have developed some sort of a ground water protection program, therefore, there is precious little for the Feds to do beyond sending down money and lending the states a hand in solving their technical problems. As a program manager of a state with one of the most progressive and sophisticated ground water protection programs, I must disagree with this position. Reasons for the disagreement are mutliple:

- While it is true that most of the states have a program, such programs are in their infancy and represent no more than a plan on paper repleat with hopeful aspirations and wishful thinking but little in the way of well staffed, well funded implementable strategies;

- There exists a great gulf between planning and implementation of such strategies;

- Because of the lack of technical information, many of the state strategies suffer great gaps that render them virtually unimplementable. One example of this dilemma is the lack of numerical standards for the bulk of the hazardous chemicals being found in the soil and the ground water. Standards are needed for both the ambient water quality and site cleanup if discharge to ground water is to be regulated and polluted sites are to be cleaned up. Another example is the lack of an indicator parameter for organics that can be used in lieu of individual chemical analysis which are too costly. A detailed list of other research needs is beyond the scope of this presentation, but a good source for such information is the office of Technology Assessment publication entitled, "Protecting the Nation's Ground Water From Contamination," Volumes I and II, OTA-0-233, October 1984.

- A primary obstacle in the way of implementation of state strategies is the shortage of state funds and qualified personnel. Because of low salaries, states invariably find themselves in a losing competition with the private consulting community over qualified chemists, hydrogeologists, toxicologists and mathematical modelers;

- Implementation of state strategies have also been hampered by their lack of jurisdiction over land use. Local governments who have traditionally been responsible for land use have rarely used the ground water as a factor in developing and implementing their zoning ordinances;

- The changing political climate, thus financial backing, in the states frequently result in discontinuation of ongoing programs that were funded by previous Legislatures. The highly successful and frequently quoted and emulated "Amnesty Days" program funded by the 1983 Florida Legislature was discontinued by the same body in 1987 (the program enabled the state to collect and properly dispose of potentially hazardous household materials).

- Because of the lack of guidance for an essential if not ideal strategy, and the lack of qualified personnel to develop one, some states have opted for adopting other state's strategies. Frequently these strategies are ill suited for the adopting state for a variety of state specific hydrogeological, legal or institutional reasons.

The above is cited to illustrate the need for an aggressive yet flexible federal role that provides national leadership and oversight while recognizing state's jurisdiction, uniqueness and independance. The only effective means for the federal government to play such a role is through Congressional legislation. Such a legislation must establish a national goal to be collectively realized by the federal, state and local government with the cooperation of the regulated community, academia and the public advocacy groups. The goal has been articulated and can be articulated in a variety of ways, but that of National Ground Water Policy Forum (which appeared in the final report of the Forum in the Conservation Foundation's publication "Ground Water Protection" 1987) is being recommended by this writer. The Forum recommends that the national goal is: "to protect the physical, chemical and biological integrity of the nation's ground water resources and ensure that they are not degraded in any way that may be harmful to humans or the environment."

For this goal to be more than mere rhetoric, certain steps and assignment of responsibilities must be delineated.

The National Ground Water Policy Forum more than adequately defined these responsibilities in a general way and left the details for Congress to elucidate through legislation. Two Congressional bills currently making their way through committees have done just that. The two bills, the Ground Water Protection Act of 1987 (S.20) and the Ground Water Research Act of 1987 (S.1105) are outstanding first steps toward the establishment of a national comprehensive ground water protection program. Passage of these bills without major erosion of their principal intents would insure the coveted federal leadership bolstered by a Congressional mandate and infused with technical and financial assistance to the states. More significantly it will also enable the states to assume the primary responsibility for ground water management and protection. They will do so by developing and implementing programs that are based on sound federal guidelines, but tailored to the state's particular needs and specific situations.

The effectiveness and implementability of these bills will be maximized if the following points are retained or introduced into the text:

- The EPA should remain the primary federal agency responsible for administering the Congressional Act;
- The USGS should, to the extent possible, remain isolated from regulatory issus, but its monitoring and research activities should be broadened to include evaluation of manmade impacts on the ground water resource;
- The most effective and readily utilizable data by the states are those generated through State/USGS Cooperative Agreements. Those are activities based on 50/50 match of state/federal monies. The only thing negative about these activities is the lack of adequate funding for this program at the state and federal levels. It is highly recommended that the USGS budget for these agreements be increased and that the ratio of participation is tilted in favor of the states. 70 percent federal and 30 percent state sharing would allow for more intensive participation by the states;
- Similar relationship between the U.S. Department of Agriculture and the states over agricultural chemicals (pesticides and fertilizers) should be established;
- The establishment of four regional Ground Water Research Institutes and a National Ground Water Clearinghouse as proposed by S.1105 is an excellent way of providing the needed information to the states for program implementation. This and the establishment of research committees and management plans also proposed in S.1105 should be supported;
- The federal government must provide incentives for the states to bolster their public education efforts regarding the impact of man's daily activities on the ground water quality;
- A balance is needed between national surveys and local or regional studies. While the national surveys are necessary for funding and policy making by Congress, they are of little

utility at the state and local levels where the actual management, protection and cleanup of the aquifers must be carried out. While this writer is not advocating a reduction of the national effort, he is recommending additional funding and emphasis of the local and regional efforts. This can best be accomplished through cooperative agreements between the three federal agencies (EPA, USGS and USDA) and the states;

- That a philosophy of resource management based on prevention of ground water pollution rather than after-the-fact reaction must be adopted and adhered to by all governmental entities at all levels;
- That management of the resource should have as its highest priority the protection and preservation of aquifers, recharge areas and the delineation and protection of future public water supplies;
- Increased attention to quality assurance for ground water sampling and analysis and development of criteria for both by the USGS and EPA respectively;
- Increased effort on making the ground water data basis more "user friendly" by the states and the development of statistical analysis methodologies of data for the purpose of generating "trends" in ground water quality.

**Legal Environmental Assistance Foundation**
203 NORTH GADSDEN STREET, SUITE 7, TALLAHASSEE, FLORIDA 32301 904-681-2591

Comments on EPA's proposed rule regarding public notification under the Safe Drinking Water Act Amendments of 1986, Federal Register, vol. 52, no. 65, pp. 10971 - 10982.

Submitted on behalf of

Legal Environmental Assistance
Foundation, Inc. (LEAF)
203 North Gadsden Street
Suite 203
Tallahassee, Florida 32301

Environmental Policy Institute
(EPI)
218 D Street, SE
Washington, D.C. 20003

## 1. Stringent public notification regulations are necessary.

Public notification is not only required by the Safe Drinking Water Act Amendments of 1986 but also an integral part of our system of government, founded in the Constitutional right to seek redress for grievances. In the case of the Safe Drinking Water Act, public notification enables citizens to become part of the decision-making process affecting the delivery of safe and dependable water supplies. This participation will ultimately benefit utilities and those responsible for maintaining drinking water quality, because informed citizens will better understand what tasks are required and what resources are necessary to provide safe drinking water.

EPA recognizes this value of public notice in the preamble to the proposed rule when it states, "public notices required by the Safe Drinking Water Act are intended to be a mechanism for organizing both public pressure and support for bringing systems into compliance." Thus, public notice requirements should be made stringent not only to protect the public health, but also as an incentive for the public water supply operators to be responsible and careful.

The following comments are based on the above considerations as well as specific mandates of the statute.

2. The proposal for tailoring notice requirements to type of violation does not recognize the seriousness of chronic health threats.

LEAF and EPI, in general, support the concept reflected in the statute and the EPA's proposal of tailoring the type and timing of notice requirements to the type of violation and the immediacy of potential health threats. We agree that it is more appropriate to base the type of notice on the difference between the violations and the seriousness of any potential adverse health affects than to make distinction between the type of public water system which is involved. The desired impact of the notice, which is protection of the public health, should drive its type and frequency.

We are concerned, however, that the tailoring approach specifically provided for in this proposal falls short of the law's intent and fails to provide for an adequate response to certain violations, particularly those which may involve chronic health risks associated with low-dose, long-term exposure. Where these non-acute problems occur, the immediacy of notice is not necessarily at issue; but the need for full and wide disclosure remains.

In particular, we submit that any MCL or treatment technique violation which poses a chronic risk to human health should be noticed through the electronic media within seven days. Clearly, chronic illnesses and diseases with a long latency period are just as important in terms of cost to the individual and society as are acute health effects, and notice regarding such threats should be complete and widespread.

We remind EPA that there is a large and growing reliance on the electronic media for news and information; for many individuals the electronic media is relied upon to the exclusion of printed materials. Thus, EPA should not base these regulations, as it appears to have done, on the faulty assumption that use of electronic media is "appropriate" only where immediacy of message delivery is the primary concern.

3. EPA should require a changing notice message for continuous violations.

We believe that Congress was correct in calling for repeat notice of continuing violations, but we also believe that repetitious notice involving an unchanging message -- i.e., there has been a violation of x requirements of the Safe Drinking Water Act -- may in itself lead to apathy or complacency about a problem. Thus, we strongly recommend that EPA select a means of requiring tiered or escalating messages.

For example, a one time violation of an MCL could be stated in a manner that conveys that there have not been previous problems, but repeated violations would have to be noticed in a manner which helps the water users to understand that the problem is a reoccurring one and that their length of exposure to contaminants is becoming extended. If a system becomes a "persistent" or "persistent squared" violator, that information should be shared in a manner that is meaningful to the consumer. Where recurring violation involves a failure to monitor, the message should also indicate that the consumers may have been exposed to the contaminant in question for x period of time.

Some states appear to be using the threat of public requirements as an enforcement hammer, and we believe that the possibility of some type of escalating public message may further motivate the recalcitrant or otherwise persistent violators of the Act to find a means of compliance.

4. Failure to test for the presence of contaminants constitutes a serious violation; such violations should be designated as Tier 1.

LEAF and EPI support the recommendation that certain monitoring and testing procedure violations be listed as Tier 1 violations. Since monitoring and testing are the first line defenses against adverse health affects, it is important to have prompt notification of this type of non-compliance.

Thus, we would suggest moving certain monitoring violations to Tier 1 and making some distinction between those frequent and repeated testing requirements that are more likely to generate opportunities for error but nonetheless provide for a good composite picture of system water quality and those testing requirements which are infrequent and for which an error is more likely to leave a major gap in water quality data.

For example, we recommend that for testing requirements that involve a monthly or more frequent testing schedule, the following violations be changed to Tier 1 violations:

(1) two or more consecutive failures to test;

(2) three or more failures to test in a single quarter; and

(3) any failure to test where the primacy agency or EPA determines that the contaminant in question is likely to be present in the system or the raw water OR that the supplier appears unwilling or unable to conduct the required testing.

For testing requirements which are infrequent, i.e., quarterly or one-time only as in the case of corrosion monitoring, all violations should be considered Tier 1. Further, these violations should be noticed repeatedly until such time as they are remedied. (Please note additional comments regarding changing public notice message.)

We understand, as implied in our comments above, that some inadvertent and less significant violations of monitoring requirements are likely to occur from time to time, such as a single missed sample where numerous samples are required, and we would support sufficient flexibility of the notice requirements to avoid "overreaction" to infrequent and minor sampling errors

Where the data set or number of samples is large, we would support some low threshold of error, e.g., one missed sample out of 15, at which the primacy agency or EPA would have discretion to waive reporting requirements unless there is some indication that the system is using the threshold cutoff as a means of lessening its monitoring burden.

**5. Failure to comply with an established deadline in a variance or exemption schedule constitutes a "double failure" that should be classified as Tier 1.**

LEAF and EPI submit that failure to meet a variance or exemption schedule should also be classified as Tier 1. If a utility is already operating under a variance or exemption, we believe that a failure to comply with the associated schedule indicates a second-level of non-compliance. This double failure indicates a problem with the facility which could be improved through public scrutiny. Consequently, the public should be apprised of this as soon as possible.

**6. Timing requirements for Tier 1 violations are not sufficiently tight.**

LEAF and EPI submit that a seven day turn-around-time is unnecessarily long. Given the immediate adverse consequences which could result from drinking contaminated water, this notice should be provided within 48 hours -- unless an emergency situation requires immediate notification. A 48-hour turn-around time could be accommodated easily with a press release and a telephone call to the local media.

Likewise, we see no need to allow for 14 days to elapse prior to posting of notice in the case of Tier 1 violations for noncommunity systems. Such posting should be required within 48 hours.

Furthermore, we recommend that the regulations make note of the fact that true emergency situations may demand much more expeditious and widespread notice than the Tier 1 requirements provide for. EPA and the primacy agencies should be clearly authorized by the regulations to require additional and extraordinary measures for notice in true emergency situations.

**7. The frequency for notice of repeated violations of maximum contaminant levels is less than that required by the statute.**

The Safe Drinking Water Act Amendments of 1986 state that

> *Notice of a continuous violation of a regulation other than a maximum contaminant level shall be given no less frequently than every 3 months. Notice of violations judged to be less serious shall be given no less frequently*

*than annually.*

In our view, the only logical interpretation of this language is that notice of violations of an MCL must be repeated more frequently than every 3 months. Given this language and the importance of the established maximum contaminant levels, we believe that repeat notice of continuing violations should be required on a monthly basis.

**8. Press releases should be required with all newspaper notices.**

The proposed regulation reduces the duration of newspaper notice from three consecutive days to a one-time publication. EPA notes that this change reduces the cost of notice but also decreases the likelihood of notice reaching the consumer by this means. We do not have serious objections to this particular change, in part because we understand that a limited number of people will actually read the legal notice section of the paper, but we would recommend that EPA add a requirement for a press release to the newspaper in all instances in which newspaper notice is required. The cost of simple press release is inconsequential, but the requirement for such a release could substantially increase the likelihood that a good number of water users would learn of the violation. Obviously, the newspaper would be free to use or not use the press release material. However, many newspapers would be likely to at least provide for some level of inquiry into noncompliance problems, and serious or persistent violations, in many instances, would be deemed newsworthy.

**9. Since mail delivery is generally the most effective means of reaching the largest number of individual customers, opportunities for waivers of such**

notice should be carefully restricted.

LEAF and EPI agree that, under certain circumstances, it may be appropriate to waive the requirement for mail delivery. We would expand the conditions of waiver, however, to include not only a determination that the violation has been corrected but also that the cause of the violation has been determined and, that there is no longer a risk to public health and that the corrective action taken substantially reduces the likelihood that a similar violation will recur.

In particular we are concerned with the situation in which a system demonstrates ongoing or recurring problems with, for example, bacteriological contamination but responds to that problem solely by running retests at a given sampling point until a "negative" result is obtained. This, in our view, does not constitute an ample response that could result in mail notice waiver.

10. EPA should require posting for multiple family dwellings, apartment complexes and other locations where individual consumers are not likely to receive a water bill.

EPA considered requiring hand delivery or posting at locations at which individual water users are unlikely to receive direct notice of violation in the mail, but the Agency decided that such a requirement was too difficult. We agree that hand delivery to all residents may, in some cases, pose a major problem, but we do not agree that posting is an overly burdensome requirement. We recommend a requirement for posting in such locations, with notices required to be posted on each floor and in "common areas" such as laundry rooms or recreation centers.

**11. Posting requirements for noncommunity systems are inadequate for cases in which children in schools or nurseries may be at risk.**

On the matter of noncommunity water system notice requirements, we point out that children, who are often most susceptible to adverse health effects caused by drinking contaminated water, may comprise a large segment of , water users. Given this fact, we believe that the proposed posting requirement is seriously deficient.

Thus, for violations in noncommunity systems serving schools or nurseries, we recommend that the regulations specifically require posting in a manner conspicuous to faculty members and to parents who may be visiting the school. In addition, the regulation should require mail notice to any existing parent-teacher organizations, to school health officials, to the appropriate local health agency and to existing community medical organizations.

**12. Annual summaries of violations would be an effective means of informing the public about drinking water regulation compliance.**

LEAF and EPI strongly support a requirement for an annual summary of the overall compliance status of the system. For those situations that require posting only, an annual summary would provide to system users a form of personal notice, documentation of all problems and the compliance history of the utility. We believe that, in the majority of cases, it would also be useful for the utilities to conduct periodic (quarterly or semiannually) meetings to discuss the operation of the utility. This would provide utilities with the opportunity to explain to the citizens the reasons for any non-compliance and to convey information regarding the level of resources necessary to ensure compliance. Such meetings might also help to establish a productive working relationship among all affected parties.

**13. Regulatory agencies should be authorized to provide for public notice directly.**

LEAF and EPI support the provisions which allow the primary agent to provide notice in lieu of the owner or operator. This provision allows for the flexibility to deal with those systems which are extremely small _or_ repeatedly recalcitrant regarding public notice. It is our understanding that some states currently provide notice in certain cases, and we would recommend that the regulations or the preamble make it clear that the states are _not_ barred from collecting any fees for notice which they determine are appropriate.

**14. Non-compliance information should be provided to new customers.**

LEAF and EPI support EPA's proposal to require community water systems to inform new customers of any violation existing at the time service begins. This provision will serve to provide customers with a baseline understanding of the status of the system and therefore encourage the new customers' support and requests for resources to achieve compliance.

**15. Contacts for additional information should be provided with all notices.**

LEAF and EPI suggest that, in addition to utility phone numbers, public notices also include the numbers for the primacy agency contact and an EPA regional office contact.

**16. Mandatory health effects language should be revised and strengthened.**

The Safe Drinking Water Act Amendments of 1986 specifically called for public notice to include information on health effects, and LEAF and EPI agree that the logical response to that requirement is the use of mandatory, prescribed language on health effects. We concur with EPA's statement that the use of such language will help to improve the quality and effectiveness of public notices, and we would argue that such language should be written in a manner which helps to convey the serious nature of drinking water regulation and the importance of a "preventative" posture. We believe that such notices must include information which will help citizens to better understand the rationale for avoiding long-term, low-level impact of exposure to contaminants which may cause adverse health effects.

In this regard, we are greatly concerned that the language required stresses, to an unreasonable degree, the reliance on animal testing. We believe that it does so in a manner which appears to be meant less for education and more for "discounting" of the need for health standards as they are required to be set by statute.

Since members of the general public may intuitively feel that animal testing has little or no relevance to human exposure, and since they may also presume that human health data is readily available, language which emphasizes but does not properly explain the reliance on animal testing data is likely to lead to a trivializing of potential risks. We agree with the implied aim of not "frightening" the public unnecessarily, and we recognize the uncertainties involved in the use of animal testing data.

We would recommend a rewrite of the health language which, at a minimum, includes the following changes:

(1) Where a "risk of cancer" is cited, it should be clear that there is a "risk to humans";

(2) References to "high doses" should be deleted unless such references are accompanied by an explanation of the need for high dose studies. (Again, the references included in the proposed language appear designed, not to inform about the nature of animal testing, but to play up to the general public's intuitive sense that "too much of anything is bad for you");

(3) Where a standard is based on epidemiological data, information on that data and its caveats should be included; and

(4) References to "margin of safety" should be consistent from one contaminant to another.

**17. EPA should propose mandatory health effects language for the existing national interim primary drinking water regulations.**

The proposed regulation fails to provide health effects language for the existing interim standards, and the discussion states that such language will not be provided until those regulations are revised at some time within the next three years. We believe that such a delay is unnecessary and in conflict with the 1986 amendments.

It is well known by EPA, the Congress, the primacy agencies and the water supply industry that there are literally thousands of violations of the Safe Drinking Water Act. Many of those involve exceedance of maximum contaminant levels established by the existing interim regulations; thus, we see an immediate need for health effects language on all contaminants now covered by the interim regulations. EPA, itself, notes in this regulation that Congress intended to "strengthen the effectiveness of notices." Given that clear intent and the selected 15-month deadline for revision of the public notification requirements, we see no legally defensible rationale for excluding currently regulated contaminants from the proposed scheme for mandatory health effects language.

EPA officials surely deal with public questions about the health implications of the existing regulations on a frequent, if not daily basis and, therefore, cannot argue that the Agency is unable to speak to these regulations. For the formulation of health effects language, EPA could easily use information on which the existing regulations are based and add to that a notation that the regulations are currently being considered for revision.

18. The regulations should be more explicit regarding the prominence of the mandatory health effects language.

LEAF and EPI believe that EPA must be very explicit and clear in order to assure that additional information on noncompliance will not be included in such a manner as to visually detract from or minimize the importance of the required language. In other words, the mandatory health effects language should not be relegated to the "fine print" or final note of a lengthy notice. We recommend that the regulations specifically require that the mandatory language be set in bold, oversize or underlined print which contrasts with the print style selected for the other information.

19. The proposed notice requirements for lead do not conform to the

requirements of the statute.

EPA explains that "Section 1417(a)(2) of the Act requires that all public water systems shall identify and provide notice to persons that may be affected by lead contamination of their drinking water...." (Underlining added.) EPA then proceeds, in direct conflict with this requirement, to require notice only for community water systems. We submit that both community and noncommunity water systems must be covered by a notice requirement; if conformance with this requirement makes it necessary, as it may well, to extend the applicability of the existing lead MCL and the special monitoring requirements for corrosivity characteristics to noncommunity systems, then EPA should proceed with the appropriate revision of the regulations.

We agree that the method of notice for noncommunity systems could vary from that required for community systems, but we again highlight our concerns regarding the effectiveness of posting as a means of notice for cases in which children are the primary water users. (Please see comments on noncommunity, nontransient water user systems.) In addition, we would argue, as we have elsewhere in these comments, that posting in locations where water users are not likely to receive individual mail notice of violations should be required.

Finally, we note some concern with the proposal to waive the notice requirement for community systems where the water "is noncorrosive." Such a determination should not, in our view, be based upon a single water sample, but must reflect data gathered over time which indicates clearly that corrosivity is not currently a concern and is not expected to be a concern.

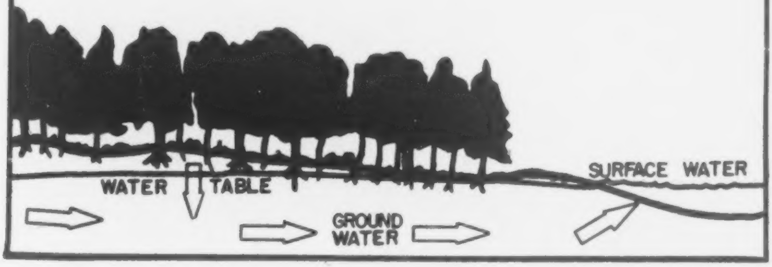
**20. State public notifications requirements less stringent than EPA's would not meet the statutory requirements for primacy.**

On this last point, we are frankly somewhat perplexed that EPA is soliciting comments. We believe firmly that state programs which provide for less stringent public notification requirements should be rejected for primacy. The notion of a minimum Federal "floor" is well accepted for many environmental laws, including the Safe Drinking Water Act. We hold that public notification is a fundamental element of effective public drinking water supply regulation. Further, it is an element which Congress devoted considerable attention to in the reauthorization of the Safe Drinking Water Act. Any effort to weaken the position of the public notification requirements -- by allowing for less stringent state programs -- would be in direct conflict with the 1986 Amendments to the Safe Drinking Water Act.

JANUARY 1987

# Selected Information

## Connecticut's
## Ground Water Management Programs


WATER TABLE
GROUND WATER
SURFACE WATER

Prepared by

CONNECTICUT DEPARTMENT OF ENVIRONMENTAL PROTECTION
WATER COMPLIANCE UNIT
165 CAPITOL AVENUE, HARTFORD, CT 06106

## HIGHLIGHTS OF

## CONNECTICUT'S GROUND WATER MANAGEMENT PROGRAM

* Statutory Authority: Connecticut's Landmark Clean Water Act of 1967 was one of the first modern water laws that placed the burden of proof on the polluter, gave the DEP broad regulatory powers and included authority to protect ground waters. This act has enabled the DEP to take enforcement actions against discharges to the ground, develop statewide ground water standards and classifications and is the foundation for today's ground water program.

* Ground Water Standards and Classifications: In 1980, Connecticut became the first state to adopt a statewide ground water standards and use classification system. Between 1980 and 1985 hearings were held through out the state to adopt specific classifications. At this time, Connecticut is the only state to have completed a classification system of this type. While the goal is to protect drinking water supplies, the need for waste disposal is recognized and the system delineates areas that are potentially suitable for waste disposal based on hydrogeologic information. These "use" classifications now regulate the siting of all land disposal facilities including sanitary landfills, hazardous waste and industrial waste. The classification maps and accompanying waste source inventory maps are at a scale detailed enough for local use and have been distributed to all 169 towns in Connecticut.

* Cooperative United States Geologic Survey (USGS): Connecticut has benefited from cooperative programs with USGS for over thirty years. For the last fifteen years, the cooperative program has focused on geologic information relevant to Connecticut's ground water management program. This statewide geologic base including information on aquifer data enabled the DEP to develop the existing classification system. Without this geologic data base, the Connecticut program would not have been able to progress as rapidly as it had. With the classification system complete, this data base now serves as resource information for individual permits and enforcement actions.

* Potable Water: The State's Potable Drinking Water Act was enacted in 1982 and amended in the 1985. This Act provides a broader coverage to those affected by contaminated ground water. The "Potable Water" statute now requires:

(1) State to bear 100 percent of the cost of bottled water for residents with contaminated drinking water supplies where no responsible party has been located. This service to continue until recommended long term solutions are in place. This is an extension of the emergency bottled water program which the Governor announced in November 1984; (2) State to continue to bear the cost of tests to confirm community contamination problems; (3) State to pay 100 per cent of the cost to cities and towns for engineering studies to determine the appropriate solutions for correcting contamination problems where no responsible party has been identified. Where no responsible party has been identified, the

state mandates municipal participation and implementation of the appropriate engineering solution to correct a contamination problem; (4) State to advance to municipalities 100 per cent of any cost for the implementation of engineering solutions during the fiscal year prior to the next town budget becoming operative; and (5) State to provide grants of between 50 and 75 per cent of the cost of the best long term solution to contamination, as determined by the engineering studies. In most instances, these solutions will fall into one of two categories — the installation of filters on private wells or the extension of water mains. The amount of each municipal grant is determined by an assessment of the town's ability to pay. Economically distressed communities would receive a relatively greater proportion of aid than those communities which are not considered to be economically distressed.

* Water Diversion Policy Act: In 1982, the State enacted the Water Diversion Policy Act which deals with the issue for water allocation. Any diversion of surface or ground water over 50,000 gallons/day now requires a state permit.

* Underground Storage of Oil and Petroleum Liquids: The State is establishing standards and criteria for the non-residential underground storage of oil, petroleum and chemical liquids. Regulations for the design, installation, operations, maintenance and monitoring for oil and petroleum liquid storage are awaiting final approval by the General Assembly.

* Local Assistance Programs: The State can delegate to any municipal agency or agent Department authority. To date, regulations for local health directors have been subject to public hearing and are to be submitted for final approval. This program will provide for review and issuance of permits for large septic systems, expanded rights of investigation and monitoring and control over many commercial activities. Other water related delegation programs are presently being developed which should greatly expand the effectiveness of the Department.

* Statewide Solid Waste Management Plan: The Solid Waste Management Plan recognizes ground water as a finite resource and recommends resource recovery as the future means of municipal refuse disposal. The State is required to adopt and enforce a statewide solid waste managment plan.

* Risk Assessment: Connecticut's citizens may be exposed to potentially toxic substances in drinking water. The State is currently identifying health risks associated with human exposure to such toxic substances and is working towards the development of standards for drinking water and for waste treatment.

* Waste Oil: The Department of Environmental Protection has the authority to set standards and criteria for non-hazardous waste oil. Regulations are being drafted which encompass nearly all aspects of waste oil management from point of generation through final disposal. In addition, the Department published and distributed guidelines for municipal waste oil collection facilities.

* Road Salt: The Department has the authority to set standards and criteria for road salt application and storage. Regulations will be drafted within the year. In addition, Best Management Practices have been developed and are recommended for implementation by the Department. They include storage, receiving, equipment maintenance and application procedures and alternatives to salt use.

* State and Local Government Partnerships: It has been the State's experience that the local land use decision making process is critical to long term protection of important ground water resources and how ground water is protected through this process deserves greater attention. The Department recognizes that the achievement of statewide goals will require a strong partnership between the State and local governments. The Department has prepared and distributed a guide for local ground water protection entitled "Protecting Connecticut's Ground Water - A Guide to Control LWater Protection for Local Officials". This guide provides basic information. on hydrologic principals, common ground water contaminants, Department pollution control programs, recommended best management practices and a chracterization of land uses and their relative degree of risk to ground water quality. A supporting document is being prepared which will recommend specific data collection, display and analysis and will also present a planning and implementation guide for ground water protection.

* Regionally Significant Aquifers: The Department of Environmental Protection is working towards the identifications of new management program needs for major aquifer systems that may have regional significance. The 1985 General Assembly provided a budget to improve the hydrogeological data on such resources and to develop management strategies for their protection. Such management strategies may involve State purchase, mandated, municipally implemented controls or other municipally implemented controls or other approaches as deemed necessary.

* Household Hazardous Waste Program: The State has provided technical assistance to over forty municipalities concerning the disposal of household hazardous waste. This assistance has included site selection, selection of haulers, suggestions of possible funding sources and public education efforts. State monies have been allocated to assist municipalities with their Household Hazardous Waste Collection Programs. The Department prepared and distributed to the public a Household Hazardous Waste flyer and a handbook dealing with "collection" days. This program has been enthusiastically received by both municipal officials and citizens.

* Water Quality Basin Plans/Update and Revision of Connecticut's Water Quality Criteria and Classification: Comprehensive water quality management planning is carried out to direct limited resources towards resolving priority water quality issues. Basin Plans use the strategies contained in DEP's Water Quality Management Plan and identify how they apply to discreet planning areas for managing water quality in specific surface and ground water resources. Connecticut's Basin Plans are designed to identify prevention and abatement strategies related to all

sources and potential sources of pollution and also provide a means for updating water resource use classifications and quality goals according to Connecticut's "Water Quality Standards and Criteria" system. The Department will be meeting with each Connecticut municipality regarding that municipality's specific water quality problems and possible solutions.

* Registration Program and Standards for Oil and Gas Exploration: The State has the authority to adopt regulations concerning a registration program and standards for oil and gas exploration. No one can engage in exploratory drilling for oil and gas until the regulations have been adopted.

* Geographic Information System (GIS): The Connecticut Ground Water Quality Classification System relies heavily on the integration of numerous resource inventories and frequent cartographic map changes during the public input process. The State is currently developing a computerized Geographic Information System which will allow for rapid revision of the water quality classification. All maps and data used in the classification process is being digitized and will be used in state of the art computer software which allows for such manipulation as: merger of map information with file information, integration of resource characteristics from many maps, statistical analysis of selected information from one or more maps, and the rapid production of new maps.

* Pesticides Task Force: The Governor's Pesticide Task Force appointed in December 1984, is currently assessing problems related to pesticide contamination including liability, property values and public education. Pesticide usage must be managed to prevent future ground water contamination.

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## Connecticut's Ground Water Strategy

The protection of Connecticut's ground water resources for its existing and growing need as a major private and public water supply source requires careful balancing with the also growing contamination threats placed on the resource by expanding land uses. The programs selected to manage ground water had to consider the competing uses, the quality and availability and the roles of the differing levels of government.

Connecticut is the fourth most densely populated state with its 3,100,000 people living within the states 3,200,000 acres. Thirty-two percent (32%) of the 3,100,000 people rely on ground water for their water supply. The water is withdrawn through 1,200 community wells, 3,300 non-community wells (restaurants, schools, hospitals, etc) and over 250,000 individual home wells. Community wells supply 441,000 people while individual wells serve 544,000 people. Community wells normally draw from stratified drift aquifers (high yielding-sand-gravel deposits) and domestic wells usually draw from bedrock aquifers (low yield fractures and faults).

Contamination of ground water has been found in 100 of our 169 towns in the last eight years as our understanding, monitoring and analytical capabilities increased. Close to 1,000 wells have been found with pollutants over drinking water standards effecting over 150,000 people. Potable water has been provided to the families through bottled water as a temporary measure and either water main extension or filter systems as a permanent measure. Contamination sources ranges from pesticides, the single largest source, to solvents, landfill leachate, gas and oil, salt and a variety of other chemicals.

As goals for ground water use were set within the framework of the existing water law and balancing the competing and often conflicting uses for ground water, management strategies emerged to clean-up, protect and allocate our ground waters. The strategy integrates many existing programs and develops new ones to manage the resources, at all times attempting to recognize the natural hydrogeologic system in which the water exists. An outline of the elements of the strategy is presented here:

### STATEWIDE GROUND WATER MANAGEMENT PROGRAMS

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| A. DRINKING WATER STANDARDS | Set quality standards for use and protection. Used as basis for permitting, and clean-up. Risk assessment used in setting criteria. |
| B. WATER QUALITY STANDARDS AND CLASSIFICATION | Primary tool to implement goals, prevent future contaminants, control uses, set priorities. Used as siting criteria and sets protection zones and allowable uses. All water classified and integrated with surface waters. Protects all public water supply. |
| C. SOURCE CONTROLS | Permit program for all point source discharges. Plume management and control and zones of influence permitted. Landfill, underground injections, lagoons, septic |

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| | systems all regulated by permits. Consistency with Water Quality Standards required. Well drilling permits and standards also required. |
| D. ENFORCEMENT | All water pollution, hazardous wastes, and clean-up programs regulations and penalties apply and administrative, civil and criminal rules are used. Super lien on contaminated properties is available. |
| E. STATEWIDE BANS | Ban of toxic septic system additives, and pesticides used on soils are used for toxics which can impact any ground waters |
| F. BEST MANAGEMENT PRACTICES | Leaking underground fuel and chemical storage tanks regulated and design standards adopted. Non-point source control on fertilizer and integrated pest management programs in place. IPM presently voluntary. Spill prevention plans part of new industrial permits. Household hazardous waste collection day funding provided to towns. Road salt storage and application regulation. |
| G. VICTIM CONPENSATION | Potable water law requires bottled water and permanent water supply be provided by responsible parties. State grant program to towns where no responsible parties. Property transfer bill requires industrial lands be cleaned up before sold to protect buyer from clean-up costs. |
| H. PLANNING | Water quality management plans and specific basin plans used as primary tools. Water supply planning required of each utility and region wide through Water Utility Coordinating Committee. State review of local zoning decisions for aquifer protection required. |
| I. WATER USE AND ALLOCATION | Diversion permit required for withdrawals over 50,000 gallons per day and impacts on surface water and other uses required. Low flow regulations require minimum stream flow be maintained from ground water base flow. Water utility regulated for quantity, quality, service areas and rates. |
| J. MONITORING | Ambient network maintained for trends at 1,200 public water supply wells. Monitoring also required at all sources and disposal sites along with plumes. |

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| K. RESEARCH | Research into bedrock and till flow systems underway. Study of regionally significant high yield stratified drift aquifers for future supply and protection. Study of pesticide distribution and potential contamination on going. Technology for clean-up being studied. |
| L. DATA MANAGEMENT | Computerized geographic information system developed for data management. Inventory of all base maps of water quality, sources, public wells, bedrock, stratified drift, till, water table contact, land uses, etc. are maintained and developed. Water use inventory maintained. |
| M. LOCAL ASSISTANCE | Ground water management guide prepared for local officials. Coordination role assigned to DEP to assist local governments in planning for aquifer protection. Technical documents prepared for best management and performance standards for local adoption. Financial assistance for local aquifer protection planning. Delegation of state permit inspection and enforcement authorities. |
| N. EDUCATION | Magazine articles part of regular publication. Maps and papers presented for public use with lectures. Household hazardous waste collection days, advertising and literature distributed. |

## REGIONAL AND LOCAL GROUND WATER MANAGEMENT PROGRAMS

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| A. LAND USE CONTROL | General, beneficial actions which can be implemented at a regional and local scale include: inclusion of ground water protection in plans of development; flood plain, open space, wetland, and agricultural lands preservation; river corridor management; acquisition of sensitive areas for parks and forests; financial incentive programs, such as tax relief; water, sewer, transportation and other infrastructure routing; inclusion of state water quality classifications in plans of conservation and development. |
| B. AQUIFER IDENTIFICATION | Specific identification of geologic formations as actual or potential withdrawal sites through detailed hydrogeologic studies which could include seismic mapping, pump tests, withdrawal models. Designation of stratified drift deposits and select bedrock |

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| | formations as regionally significant or locally significant aquifers. |
| C. AQUIFER PROTECTION | Specific regulatory and non-regulatory management techniques are applied to specific geographic areas which have been identified as principal water withdrawal sites, such as: aquifer protection zones; land acquisition of sensitive areas; conservation easements; purchase or transfer of development rights; designation as historic or archeologic sites; specific performance controls on specific land and water uses. |
| D. PERFORMANCE STANDARDS | Detailed controls on the storage, use and disposal of materials, products and wastes and detailed standards on the siting, construction and maintenance of facilities and their associated support features. These appear as either specific criteria and limits in zoning regulations for special permit uses or in town-wide ordinances for such select facilities as fuel and other hazardous material storage, storm water management, sewage disposal system construction, operation and maintenance. |
| E. WELL PROTECTION | Quality assurance of private, homeowner wells is sought through the traditional consideration given to well siting, construction and testing; setback requirements; certificates of occupancy issuance; inspection of withdrawal and delivery systems. |
| F. HOUSEHOLD WASTES | Household materials use and disposal is manageable through information and education programs; a household hazardous materials collection program; secure disposal options at local sanitary landfills; segregation and recycling at centralized facilities; designation of non-toxic alternative products. |
| G. MONITORING AND INSPECTIONS | Assuring compliance with regulatory and non-regulatory management initiatives. Local program elements are accomplished through designation of enforcement agents and detail of their inspection responsibilities, applicable enforcement standards, authorities and penalties. |

## SUMMARY OF CT PUBLIC ACT 85-279

## AN ACT CONCERNING THE PROTECTION OF PUBLIC WATER SUPPLIES

SUMMARY:

This public act makes the Commissioner of Health Services a party to any municipal board and commission hearing concerning proposed changes in planning or zoning regulations or granting building or use permits that would affect public water supply and allows him to appeal such municipal decisions whether he appealed before the board or not.

If the municipal decision were upheld in such an appeal, the public act requires the state to reimburse the municipality within three months for its costs in defending the appeal.

The public act also allows the commissioner to issue orders to prevent or stop conditions or activities that he judges will result in imminent and substantial damage to a public water supply. The commissioner would be required to hold a hearing within 10 days of issuing the order to allow the person subject to it an opportunity to demonstrate that no damaging condition exists. The order would have to remain in effect for 10 days after the hearing during which time a new decision based on the hearing would have to be made.

Finally, the public act requires, rather than merely allows municipal planning and zoning commissions to consider protection of existing and potential public surface and ground water supplies in their plans and regulations.

Effective date of public act: October 1st, 1985.

## PUBLIC ACT NO. 85-279

AN ACT CONCERNING THE PROTECTION OF PUBLIC WATER SUPPLIES.

Section 1. (NEW) The commissioner of health services or his designee may submit written testimony to any municipal board or commission and may appear by right as a party to any hearing before such municipal board or commission concerning any proposed municipal plan of development or zoning regulations or changes thereto affecting a public water supply or a municipal approval, permit or license for a building, use or structure affecting a public water supply and said commissioner may appeal, or appear as a party to any appeal of, a municipal decision concerning such matters whether or not he has appeared as a party before the municipal board or commission. If the decision of such board or commission is upheld by a court of competent jurisdiction, the state shall reimburse the municipality within three months for all costs incurred in defending the appeal.

Sec. 2. (NEW) If the commissioner of health services finds after investigation that any person is causing, engaging in or maintaining, or is about to cause, engage in or maintain, any condition or activity which, in his judgment, will result in or is likely to result in imminent and substantial damage to a public water supply, he may, without prior hearing, issue a cease and desist order in writing to such person to discontinue, abate or alleviate such condition or activity. Upon receipt of such an order such person shall immediately discontinue, abate or alleviate or shall refrain from causing, engaging in or maintaining such condition or activity. The commissioner shall, within ten days after such order, hold a hearing to provide the person an opportunity to be heard and show that such condition does not exist. Such order shall remain in effect until ten days after the hearing within which time a new decision based on the hearing shall be made.

Sec. 3. Section 8-2 of the general statutes is repealed and the following is substituted in lieu thereof:

The zoning commission of each city, town or borough is authorized to regulate, within the limits of such municipality, the height, number of stories and size of buildings and other structures; the percentage of the area of the lot that may be occupied; the size of yards, courts and other open spaces; the density of population and the location and use of buildings, structures and land for trade, industry, residence or other purposes, and the height, size and location of advertising signs and billboards. Such zoning commission may divide the municipality into districts of such number, shape and area as may be best suited to carry out the purposes of this chapter; and, within such districts, it may regulate the erection, construction, reconstruction, alteration or use of buildings or structures and the use of land. All such regulations shall be uniform for each class or kind of buildings, structures or use of land throughout each district, but the regulations in one district may differ from those in another district, and may provide that certain classes or kinds of buildings, structures or use of land are permitted only after obtaining a special permit or special exception from a zoning commission, planning commission, combined planning and zoning commission or zoning board of appeals, whichever commission or board the regulations may, notwithstanding any special act to the contrary, designate, subject to standards set forth in the regulations and to conditions necessary to protect the public health, safety, convenience and property values. Such regulations shall be made in accordance with a comprehensive plan and shall be designed to lessen congestion in the streets; to secure safety from fire, panic, flood and other dangers; to promote health and the general welfare; to provide adequate light and air; to prevent the overcrowding of land; to avoid undue concentration of population and to facilitate the adequate provision for transportation, water, sewerage, schools, parks and other public requirements. Such regulations shall be made with reasonable consideration as to the character of the district and its peculiar suitability for particular uses and with a view to conserving the value of buildings and encouraging the most appropriate use of land throughout such municipality. Such regulations shall also encourage the development of housing opportunities for all citizens of the municipality consistent with soil types, terrain and infrastructure capacity. Zoning regulations may be made with reasonable consideration for the protection of historic factors and SHALL BE MADE WITH REASONABLE CONSIDERATION for the protection of existing and potential public surface and ground drinking water supplies. The regulations shall provide that proper provision be made for soil erosion and sediment control pursuant to section 22a-329. Such regulations may also encourage energy-efficient patterns of development, the use of solar and other renewable forms of energy, and energy conservation. The regulations may also provide for incentives for developers who use passive solar energy techniques, as defined in subsection (b) of section 8-25, in planning a residential subdivision development. The incentives may include, but not be limited to, cluster development, higher density development and performance standards for roads, sidewalks and underground facilities in the subdivision. Such regulations shall not prohibit the continuance of any nonconforming use, building or structure existing at the time of the adoption of such regulations. Any city, town or borough which adopts the provisions of this chapter may, by vote of its legislative body, exempt municipal property from the regulations prescribed by the zoning commission of such city, town or borough; but unless it is so voted municipal property shall be subject to such regulations.

Sec. 4. Section 8-23 of the general statutes is repealed and the following is substituted in lieu thereof:

The commission shall prepare, adopt and amend a plan of development for the municipality. Such plan shall show the commission's recommendation for the most desirable use of land within the municipality for residential, recreational, commercial, industrial and other purposes and for the most desirable density of population in the several parts of the municipality. Such plan may also show the commission's recommendation for a system of principal thoroughfares, parkways, bridges, streets and other public ways; for airports, parks, playgrounds and other public grounds; for general location, relocation and improvement of public buildings; for the general location and extent of public utilities and terminals, whether publicly or privately owned, for water, sewerage, light, power, transit and other purposes; and for the extent and location of public housing projects. Such other recommendations may be made by the commission and included in the plan as will, in its judgment, be beneficial to the municipality. The plan of development shall be a statement of policies, goals and standards for the physical and economic development of the municipality, and may include all necessary and related maps, explanatory material, photographs, charts or other pertinent data and information relative to the past, present and future trends of the municipality, and may include recommended programs for the implementation of the plan, including a schedule and budget for public capital projects, and a program for enactment and enforcement of zoning and subdivision controls, building and housing codes and safety regulations. In preparing such plan the commission shall consider the community development action plan of the municipality, if any, AND THE PROTECTION OF EXISTING AND POTENTIAL PUBLIC SURFACE AND GROUND DRINKING WATER SUPPLIES, and may consider physical, social, economic and governmental conditions and trends, including, but not limited to, local, regional and state studies of the human resource, education, health, housing, recreation, social services, public utilities, public protection, transportation and circulation, cultural and interpersonal communications needs of the municipality [, the protection of existing and potential public surface and ground drinking water supplies] and the objectives of energy-efficient patterns of development, the use of solar and other renewable forms of energy, and energy conservation. The plan shall be designed to promote with the greatest efficiency and economy the coordinated development of the municipality and the general welfare and prosperity of its people. The commission may prepare and adopt plans for the redevelopment and improvement of districts or neighborhoods which, in its judgment, contain special problems or show a trend toward lower land values. The commission may adopt the plan of development by a single resolution or may, by successive resolutions, adopt parts of the plan, whether geographical or functional, and amendments thereto. Prior to adopting the development plan or any part thereof or amendment thereto, the commission shall file in the office of the town clerk a copy of such plan or part thereof or amendment thereto but, in the case of a district commission, such commission shall file such information in the offices of both the district clerk and the town clerk, and shall hold at least one public hearing thereon, notice of the time and place of which shall be published in a newspaper having general circulation in the municipality at least twice at intervals of not less than two days, the first not more than fifteen days, nor less than ten days, and the last not less than two days prior to the date of each such hearing, which notice shall make reference to the filing of such records in the office of the town clerk, or both the district clerk and the town clerk, as the case may be. Any plan or part thereof or amendment thereto shall, upon adoption by the commission, be filed in the office of the town clerk, but, if it is a district plan or amendment, it shall be filed in the offices of both the district and town clerk, and shall become effective at a time established by the commission, provided notice thereof shall be published in a newspaper having general circulation in the municipality prior to such effective date.

STATE OF CONNECTICUT
DEPARTMENT OF ENVIRONMENTAL PROTECTION

## PROGRAM TITLE: MUNICIPAL GRANTS FOR THE PROVISION OF POTABLE WATER

OBJECTIVES OF PROGRAM: Provide for State funding assistance to municipalities wherein ground water pollution has occurred and the Department of Environmental Protection (DEP) has been unable to identify a responsible party.

ELIGIBILITY REQUIREMENTS: (1) Water supply wells, either public or private, are contaminated; (2) the DEP is unable to identify the party responsible for the ground water contamination or the responsible party is financially incapable of providing potable water; and (3) the DEP has issued an Order to the municipality to provide potable water.

APPLICATION AND AWARD PROCESS: The water supply grant application and award process is similar to the DEP sewer construction grant process; the grant award is based upon DEP approved engineering report which describes the problem, area and population affected by pollution of the groundwaters; alternate solutions including relative cost of construction or installation, operation and maintenance and design criteria on all alternate solutions and any other information which the Commissioner of DEP deems necessary.

GRANT ASSISTANCE PROVIDED: The grant assistance is 100% reimbursement to municipalities for the cost of the engineering report required by the grant process and from 50 to 75% of the eligible construction/installation costs. The 50 to 75% assistance is based upon the relative ranking of all municipalities in accordance with each municipality's adjusted equalized net grand list per capita as defined in Section 10-261, Ct General Statutes.

ASSISTANCE CONSIDERATIONS: No State funds shall be distributed to a municipality for the cost of operating or maintaining any potable water supply facilities other than as specified in CGS Section 22a-471. Municipalities within which the DEP has identified a party responsible for groundwater pollution are not eligible for a grant through this program.

POST ASSISTANCE CONSIDERATIONS: Where water supplies are being treated, the State will pay for 50 to 75% of the cost of monitoring and maintaining the system during the first year of operation.

FUNDING LEVEL: Four million-eight hundred thousand dollars ($4.8 million) in bond funds for grants to municipalities for long term capitol improvements, such as water main extensions, will be available for FY1987; One and one-half ($1.5 million) dollars will be deposited in the DEP Emergency Response Fund for short term provision of potable water and engineering studies.

STATUTORY AUTHORITY: CGS Sections 22a-471 and 22a-451.

AGENCY CONTACTS: Elsie Patton, Principal Environmental Analyst, DEP/WCU; or William Hogan, Engineer of Water Pollution Control Facilities, DEP/WCU; 122 Washington St., Hartford, Ct 06106. Telephone number 566-2373.

November 1986

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## *GROUND WATER MANAGEMENT IN CONNECTICUT*

***A. Connecticut recognizes three basic types of ground water systems for administrative purposes.***

*1) Regionally significant aquifers: Areas which lie within the political bounds of several towns and which DEP has identified as large areas of coarse grained stratified drift with a saturated thickness of greater than forty feet. A potential yield of greater than five million gallons per day from each of these deposits is expected. Tentatively, 40 such areas have been identified. In 1985, the General Assembly authorized the expenditure of $125,000 for detailed hydrogeologic studies of these sites and the preparation of management alternatives for their protection. Such protection could include state acquisition, local acquisition, state mandated local land use controls or other similar actions.*

*2) Local aquifers: Areas which lie within the political bounds of a single municipality and which represent locally significant stratified drift water sources. DEP at this time is providing technical assistance to municipalities in identification of such areas and appropriate protective control measures.*

*3) Other ground waters: These ground waters constitute the bedrock aquifers and all other stratified drift deposits throughout the state. DEP provides technical assistance to municipalities in protection of these actual or potential water sources.*

***B. State directed or initiated ground water protection measures.***

*1) Classification of all ground waters through the Water Quality Standards program into basically four use classes:*
*GAA - existing public water supply sources*
*GA - existing or potential private water supply sources*
*GB - ground waters known or presumed contaminated*
*GC - ground water areas where potential for major public water supply development is minimal but conditions for certain waste disposal activities may be favorable.*

*2) Regulation of all discharges from all sources. Prohibition of discharges from areas where public or private water supplies exist and/or where ground water is now known or presumed to be suitable for direct human consumption.*

*3) Regulation of all diversions of surface or ground waters in excess of 50,000 gallons per day. Impacts of such diversions on existing and potential water quality and quantity and uses must be considered.*

*4) Requirement for all utilities providing public water to prepare long range plans for water supply activities. Adequacy of existing supply quality and quantity must be considered as well as quality of future sources.*

5) *Ban on sale of all septic system additives which contain toxic or hazardous substances.*

6) *Regulation of storage of non-residential oils, petroleum and chemicals. Enabling legislation was followed by DEP regulations.*

7) *Commissioner of DEP empowered to order municipal provision of drinking water to homeowners with contaminated supplies when polluter unknown. State able to provide 50% match on costs for such water service.*

8) *Commissioner of DEP empowered to delegate inspection monitoring and enforcement authority to selectmen or town employees for certain waste disposal activities under DEP permit.*

9) *Commissioner of DEP empowered to issue orders for pollution abatement and clean-up to those found causing surface or ground water pollution. Recent legislation enable DEP to hold responsible all existing owners factility operators or deed/title holders for cost of clean-up (Superlien).*

10) *Spill response by DEP staff to all chemical or oil spills or accidents.*

11) *Regulation on treatment storage and disposal of all hazardous wastes generated or handled by any facility where 1000 Kg involved in a 30-day period. (RCRA).*

12) *Development of waste-to-energy facilities for disposal of mixed municipal wastes in lieu of sanitary landfills. (CRRA).*

13) *Regulation on storage and application of road salts by municipal, state and private entities.*

14) *Memorandum of Agreement between Departments of Health Services and Environmental Protection on sharing of responsibility for protection of public and private water supplies.*

15) *Development of Water Quality Management Plans which integrate surface and ground water quality protection management efforts of DEP.*

16) *Development of "Protecting Connecticut's Ground water: A Guideline for Local Officials". Introductory handbook on hydrologic principles, ground water sources, contamination threats, state controls, local responsibilities, guidelines for local control of certain activities through use of Best Management Practices*

17) *Development of Best Management Practices for the storage, use and disposal of fuels and lubricant, organic wastes, fertilizers and pesticides in agriculture.*

18) *Technical and financial assistance in the collection of household hazardous wastes and its safe disposal.*

19) *Enactment of legislation requiring local planning and zoning commissions to consider the protection of existing and future sources of water supply, whether form surface water or ground waters. (P.A. 85-279).*

20) *Sewer avoidance program, requiring communities which have been ordered to correct community wide pollution problems due to failing septic systems, to create a local Water Pollution Control Authority. Authority is to cause creation of pollution control strategy and construction of pollution control facilities.*

21) *Inventory and mapping of all known leachate and wastewater discharge sources and provision at same to local Directors of Health.*

22) *Legislation empowering local Directors of Health to request from local business and industries a listing of all toxic and hazardous substances stored. List may also be provided to local Fire Marshall.*

*November 1986*

STATE OF CONNECTICUT
DEPARTMENT OF ENVIRONMENTAL PROTECTION

## CONNECTICUT'S POTABLE WATER LAW

1. Summary

If the Commissioner determines that ground water is polluted or can reasonably be expected to become polluted and the Commissioner of Health Services determines that pollution presents an unacceptable risk of injury to the health or safety of persons using such ground waters for drinking or other personal or domestic uses, the Commissioner of Environmental Protection may order the responsible party to provide potable drinking water to the people affected. Sec. 22a-471(a), C.G.S., as amended by Public Act 85-407.

2. Liability

a. "Responsible" is not defined, but, for example, responsible parties in the area of pesticide contamination might include the manufacturer, distributor, applicator or user of the polluting substance and the person causing or allowing the polluting substance to be applied or discharged. A mere landowner is not liable. Sec. 22a-471(d).

b. The Commissioner must try to apportion liability among responsible parties, if appropriate. Sec. 22a-471(a) (1), C.G.S.

c. If the Commissioner cannot determine who is responsible for the pollution, or if the responsible party has no assets other than land, buildings, business machinery or livestock and cannot obtain a loan at a reasonable rate of interest, the Commissioner may order the municipality in which the contamination occurs to provide water. The municipality may apply for a grant from the state. Sec. 22a-471(a) (1), C.G.S., Sec. 22a-451(d), C.G.S. and 22a-471(b), C.G.S.

d. The Commissioner may issue an order even if the pollution occurred before the effective date of the act. Sec. 22a-471(a) (5), C.G.S.

3. Required Action: Under an order, the Commissioner of Environmental Protection and the Commissioner of Health Services will approve a short-term and long-term system of providing enough water for all personal and domestic uses. Sec. 22a-471(a) (2), C.G.S.

4. Other Provisions

a. The Commissioner must provide bottled water to residences and schools when he determines that pollution has occurred and the Commissioner of Health Services determines that such pollution creates or could create an unacceptable health risk. This would continue until a responsible party, municipality or water company provides potable water. Sec. 22a-471(a) (1), C.G.S.

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b. The statute specifies requirements for engineering reports and standards for approval of solution. Sec. 22a-471(a) (2), C.G.S.

c. The Commissioner shall make grants to municipalities not responsible for pollution if ordered (see 2(c) above) to provide potable water. Grants are as follows:

   i. 100% for short-term (bottled water).

   ii. 100% for required engineering reports.

   iii. 50-75% for capital improvements for most cost-effective solution.

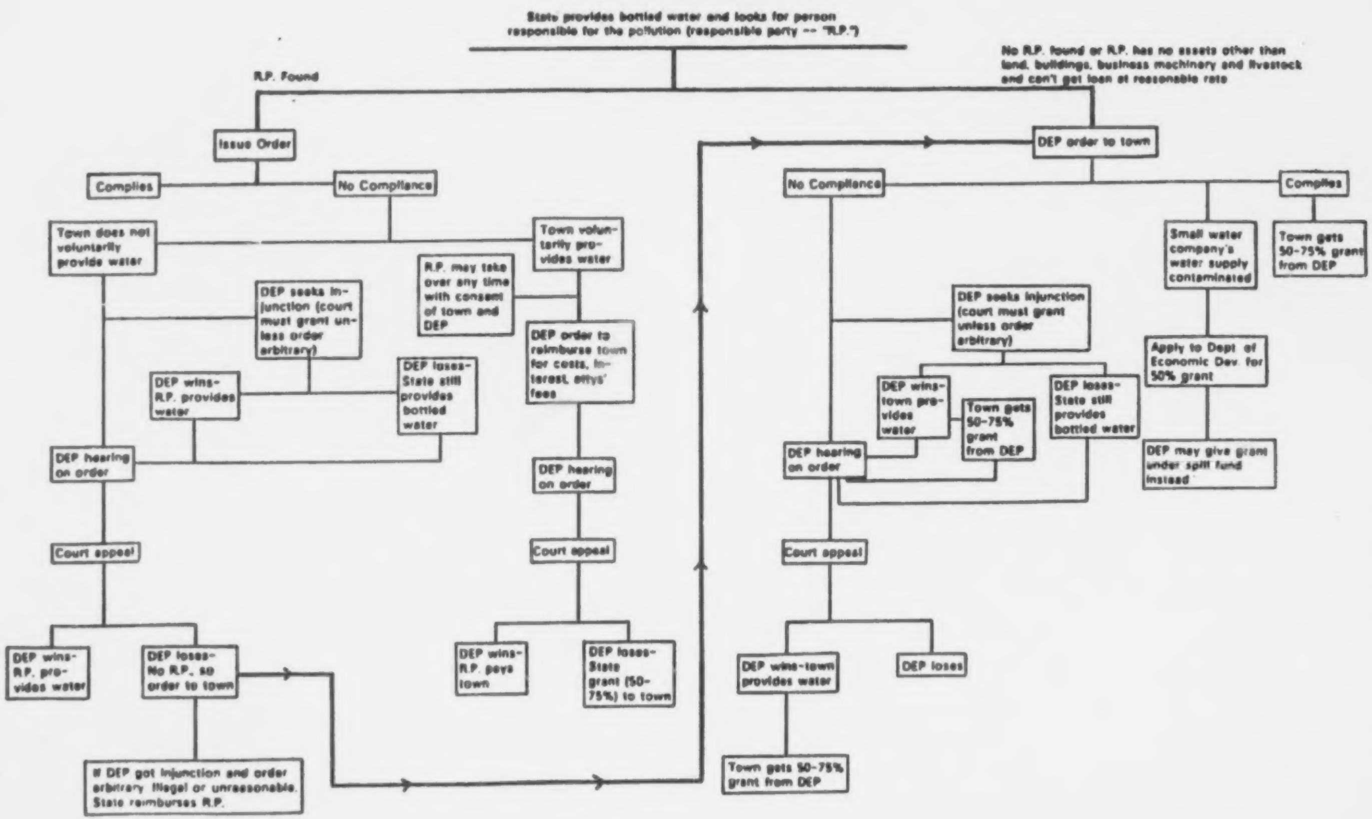
   iv. 50-75% for cost of monitoring and maintaining individual treatment systems for first year.

e. Commissioner can advance any funds needed by municipality, provided funds are reimbursed to level consistent with final percentage of grant. Sec. 22a-471(b) (1), C.G.S.

f. Commissioner may order responsible parties to reimburse the state, a municipality or water company which provided potable water (under order or voluntarily) for all costs incurred. [Note: would allow town to voluntarily provide water even where responsible party was known if did not want to wait for litigation or other delays, and the Commissioner could recover the costs for the town]. Sec. 22a-471(b) (4) (B), C.G.S.

## CONNECTICUT'S POTABLE WATER LAW
(Sec. 22a-471 of the Connecticut General Statutes, as amended by P.A.85-467)

### STATE FINDS CONTAMINATED WELLS


State provides bottled water and looks for person responsible for the pollution (responsible party -- "R.P.")
R.P. Found
No R.P. found or R.P. has no assets other than land, buildings, business machinery and livestock and can't get loan at reasonable rate
Issue Order
Complies
No Compliance
Town does not voluntarily provide water
Town voluntarily provides water
R.P. may take over any time with consent of town and DEP
DEP seeks injunction (court must grant unless order arbitrary)
DEP wins-R.P. provides water
DEP loses-State still provides bottled water
DEP order to reimburse town for costs, interest, attys' fees
DEP hearing on order
Court appeal
DEP wins-R.P. provides water
DEP loses-No R.P., so order to town
If DEP got injunction and order arbitrary illegal or unreasonable, State reimburses R.P.
DEP hearing on order
Court appeal
DEP wins-R.P. pays town
DEP loses-State grant (50-75%) to town
DEP order to town
No Compliance
Complies
Small water company's water supply contaminated
Town gets 50-75% grant from DEP
Apply to Dept of Economic Dev. for 50% grant
DEP may give grant under spill fund instead
DEP seeks injunction (court must grant unless order arbitrary)
DEP wins-town provides water
Town gets 50-75% grant from DEP
DEP loses-State still provides bottled water
DEP hearing on order
Court appeal
DEP wins-town provides water
DEP loses
Town gets 50-75% grant from DEP

## RANKING OF LAND USE CATEGORIES BY THEIR RISK TO GROUND WATER QUALITY

LEAST RISK

↓

A.
1. WATER COMPANY OWNED LAND
2. DESIGNATED, PASSIVE RECREATION OPEN SPACE
3. FEDERAL, STATE, LOCAL, PRIVATE PARKS AND FORESTS
4. PRIVATE LANDS MANAGED FOR FOREST PRODUCTS
5. DEVELOPED RECREATIONAL USE, PUBLIC PARKS

B.
1. FIELD CROPS - PERMANENT PASTURE, HAY CROPS, CORN VEGETABLES
2. LOW DENSITY RESIDENTIAL - (≤ 2 ACRE LOTS)
3. CHURCHES, MUNICIPAL OFFICES

C.
1. AGRICULTURAL PRODUCTION -DAIRY, LIVESTOCK, POULTRY -NURSERY, TOBACCO CROPS, ORCHARDS
2. GOLF COURSE
3. MEDIUM DENSITY RESIDENTIAL - (1/2 TO 1 ACRE LOTS)

D.
1. INSTITUTIONAL USES - SCHOOLS, HOSPITALS, NURSING HOMES, PRISONS
2. HIGH DENSITY HOUSING - (< 1/2 ACRE LOTS)
3. COMMERCIAL - WITH NOTHING MORE THAN SEWAGE DISCHARGES

E.
1. RETAIL COMMERCIAL - GASOLINE STATIONS, DRY CLEANERS, PHOTO PROCESSORS, MEDICAL ARTS, FURNITURE STRIPPERS, BEAUTY SHOPS, JUNK YARDS
2. INDUSTRIAL - MANUFACTURING, PROCESSING, RESEARCH FACILITIES
3. WASTE DISPOSAL - LAGOONS, LANDFILLS, BULKY WASTES

MOST RISK

* IT IS IMPORTANT TO RECOGNIZE THAT RISKS TO GROUND WATER QUALITY AND TO GROUND WATER USERS CAN BE REDUCED IF SEWERS AND A WATER LINE SERVE AN AREA, AND STRINGENT STORAGE REGULATIONS ARE ADOPTED, AND PERIODIC PROFESSIONAL INSPECTIONS ARE MADE OF HIGH RISK FACILITIES.

# LISTING OF GROUND WATER RISKS BY ZONING CATEGORIES

## RESIDENTIAL

### RESIDENTIAL AND AGRICULTURAL ACTIVITIES (SINGLE AND MULTI-FAMILY)

FERTILIZERS-USE, STORAGE, DISPOSAL
FUEL OIL STORAGE
HOUSEHOLD HAZARDOUS MATERIALS - USE, STORAGE, DISPOSAL
PESTICIDE-USE, STORAGE, DISPOSAL
SEPTIC TANK ADDITIVES
STORMWATER RUNOFF
WASTE OIL DISPOSAL
WATER CONDITIONER-DISCHARGES
WATER CONSERVATION-LACK OF IT

# LISTING OF GROUND WATER RISKS BY ZONING CATEGORIES

## COMMERCIAL

### COMMERCIAL ACTIVITIES
### (TRADES & SERVICES)

AIRCRAFT LANDING FIELDS
AGRICULTURAL WASTES
ASPHALT TESTING
AUTOMOBILE - DEALERS, BODY SHOPS, REPAIR SHOPS, SERVICE STATIONS, WASHES
BEAUTY SALONS
BULKY AND MIXED MUNICIPAL WASTE DISPOSAL
COLLEGES, TRADE SCHOOLS
CONCRETE MOLDING
DRY CLEANERS
FOOD PROCESSING
FUEL OIL DISTRIBUTORS
FURNITURE STRIPPERS
GOLF COURSES
GREENHOUSES & NURSERIES
HAZARDOUS WASTE TREATMENT, STORAGE, DISPOSAL
JUNK & SALVAGE YARDS
LAWN CARE
LAUNDROMATS
MEDICAL ARTS - DENTAL, HOSPITALS, VETERINARIANS
NURSING & REST HOMES
PHOTO PROCESSING
PRINTERS
REPAIR SHOPS - APPLIANCES, SMALL ENGINES
RESEARCH LABORATORIES
ROAD SALT STORAGE
SEPTAGE, SEWAGE SLUDGE SPREADING
STORAGE, WAREHOUSING OF PESTICIDES, FERTILIZERS, CHEMICALS
TRANSPORTATION TERMINALS

# LISTING OF GROUND WATER RISKS BY ZONING CATEGORIES

## INDUSTRIAL

### INDUSTRIAL ACTIVITIES
### (MANUFACTURING & PROCESSING)

ADHESIVES, SEALANTS
BATTERIES
CHEMICALS
ELECTRICAL EQUIPMENT
ELECTROPLATING
EXPLOSIVES
FERTILIZERS
GLASS
INSTRUMENTS
IRON, STEEL & NON-FERROUS METALS
LEATHER
MACHINE SHOPS
METAL HEAT TREATING
PAINT & INK
PAVING & ROOFING
PESTICIDE
PHARMACEUTICAL
PLASTIC & FIBERGLAS FABRICATING
PULP & PAPER
RUBBER GOODS
SMELTING
STEAM & ELECTRIC
STONE & CLAY PRODUCTS
TEXTILES
WOOD PROCESSING

## ORGANIZATION OF TYPICAL CONNECTICUT MUNICIPAL GOVERNMENT

### LOCAL BOARDS/COMMISSIONS/COMMITTEES/AGENCIES

ALDERMAN
APPEALS
ARTS

BUILDINGS

CONSERVATION

DEVELOPMENT

EDUCATION
ELDERLY
ELECTORS
ENERGY
ENVIRONMENT
ETHNICS

FAIR RENT
FINANCE
FIRE
FLOOD & EROSION CONTROL

HARBORS
HEALTH
HISTORIC DISTRICT
HOUSING
HUMAN SERVICES

INLAND WETLANDS
INSURANCE

LAKES

PARKING
PENSIONS

PERSONNEL
PLANNING

POLLUTION CONTROL
PUBLIC WORKS

PURCHASES

RECREATION
RENEWAL
RETIREMENT

SAFETY

SEWERS
SHELLFISH

TAXATION

WATER RESOURCES
WELFARE

YOUTH SERVICES
ZONING

* HOW WELL IS YOUR TOWN ORGANIZED AND IS IT ADEQUATE FOR YOUR LAND AND WATER USE MANAGEMENT NEEDS?

## TYPICAL CONNECTICUT MUNICIPAL GOVERNMENT STAFFING

- ASSESSOR
- BUILDING INSPECTOR
- CHIEF ADMINISTRATIVE OFFICER (MAYOR, SELECTMAN, TOWN MANAGER)
- CHIEF OF FIRE DEPARTMENT & FIREMEN
- CHIEF OF POLICE & CONSTABLES
- CLERK AND REGISTRAR OF VITAL STATISTICS
- CITY ENGINEER
- DIRECTOR, SUPERINTENDENT OR ADMINISTRATOR OF:
  - ADMINISTRATIVE SERVICES
  - CIVIL PREPAREDNESS
  - COMMUNITY DEVELOPMENT
  - CONSERVATION
  - DEVELOPMENT
  - ELDERLY SERVICES
  - ENERGY
  - FINANCE
  - FLOOD CONTROL
  - GRANTS
  - HEALTH
  - HIGHWAYS
  - LIBRARY
  - PARKS & RECREATION
  - PERSONNEL
  - PUBLIC WORKS
  - PURCHASING
  - SANITATION
  - SCHOOLS
  - SOCIAL SERVICES
  - STREETS AND BRIDGES
  - TOWN DEPOSIT FUND
  - VETERAN'S SERVICES
  - WELFARE
  - WASTEWATER TREATMENT
  - WATER SYSTEMS
  - YOUTH SERVICES
- FIRE MARSHAL
- JUSTICES OF THE PEACE
- REGISTRAR OF VOTERS
- SANITARIAN
- SEALER OF WEIGHT AND MEASURES
- TAX COLLECTOR
- TOWN ATTORNEY
- TOWN PLANNER
- TREE WARDEN
- TREASURER
- ZONING ENFORCEMENT OFFICER

* HOW WELL IS YOUR TOWN STAFFED AND IS IT ADEQUATE FOR YOUR LAND AND WATER USE MANAGEMENT NEEDS?

PUBLIC HEALTH PROTECTION IS AN IMPORTANT CONCERN IN YOUR TOWN, IT SHOULD COVER ALL THE FOLLOWING SPECIFIC ACTIVITIES. IF YOUR TOWN HAS ONE STAFF PERSON RESPONSIBLE FOR HEALTH ISSUES, THE FOLLOWING SHOULD BE CONSIDERED:
:

## SUGGESTED
## DUTIES & RESPONSIBILITIES OF A TOWN SANITARIAN (HEALTH AGENT OR OFFICER)

| | |
|---|---|
| 1. Subsurface Sewage Disposal: | Planning for sewer avoidance, soil testing, review engineering plans, inspect septic systems, enforce Public Health Code and related State statutes and local regulations and ordinances pertaining to subsurface sewage disposal. Oversees correction of failed systems. |
| 2. Food Establishments: | Quarterly inspections of all establishments serving or dispensing foods and beverages; includes, restaurants, school cafeterias, street vendors, grocery stores, etc. |
| 3. Safety: | Inspect all public schools for safety, environmental health. |
| 4. Water Supply: | Approves well locations, investigates well contamination, interprets water quality reports. |
| 5. Vector Control: | Investigates complaints of rodent, mosquito, insect infestations. |
| 6. Housing: | Investigates rented dwellings, tenement buildings hotels, motels, boarding houses for health and sanitation. |
| 7. Waste Disposal: | Inspects local sanitary landfill, commercial and industrial waste handling and disposal, verifies accuracy and completeness of state wastewater sources maps. |
| 8. Recreation Areas: | Inspects recreational and bathing areas for health considerations. |
| 9. General Water Pollution: | Surveys Town for water quality problems, collects samples, investigates sources of contamination, interprets state water quality standards and classifications for use at local level. |

| | |
|---|---|
| 10. Coordination: | Confers with State government agencies such as DEP, DHS, regarding environmental health issues. Acts as liaison to regional groups and neighboring towns on health. |
| 11. Health Nuisances: | Investigates all existing or potential general health nuisances including manure storage, fly problems, garbage collection and storage. |
| 12. Septage/Garbage: | Inspects garbage trucks, septic tank cleaners for conformance to general public health standards. |
| 13. Advisory: | Acts as local health agent; providing advice to first selectman, building official, town engineer, all boards and commissions concerning Public Health issues in municipality. Confers with Director of Health, School nurses, other health professions in Town government. |

THE UNIVERSITY OF CONNECTICUT
Cooperative Extension Service
[illegible]

MIDDLESEX COUNTY EXTENSION OFFICE
SAYBROOK ROAD
HADDAM, CT 06438 Tel.345-4511

# CONNECTICUT PLANS OF DEVELOPMENT

By Jim Gibbons
Cooperative Extension
Community Resource Development Agent

## Legal Basis:

Section 8-23 of the General Statutes of Connecticut, Revised to January 1, 1979 states that a local planning "commission shall prepare, adopt and amend a plan of development for the municipality."

## Plan Requirements:

1. Section 8-23 stipulates that such plan shall show the planning "commission's recommendation for the most desirable use of land within the municipality for residential, recreational, commercial, industrial and other purposes."

2. The plan shall show the planning commission's recommendations "for the most desirable density of population in the several parts of the municipality."

3. The plan shall be "a statement of policies, goals and standards for the physical and economic development of the municipality."

4. In preparing such a plan the commission "shall consider the community development action plan of the municipality if any" exists.

5. The plan shall be designed to promote with the greatest efficiency and economy the coordinated development of the municipality.

## The Plan May Also Include:

1. The commission's recommendations for:
   a) a system of principal thoroughfares, parkways, bridges, streets and other public ways.
   b) airports, parks, playgrounds and other public grounds.
   c) the general location, relocation and improvement of public buildings.
   d) the general location and extent of public utilities and terminals, whether publicly or privately owned, for water, sewerage, light, power, transit and other purposes.
   e) the extent and location of public housing projects.
   f) other recommendations that in the judgment of the commission would be beneficial to the municipality.

2. All necessary and related maps, explanatory material, photographs, charts or other pertinent data relative to past, present and future trends of the municipality.

3. Programs for the implementation of the plan including a schedule and budget for public capital projects and a program for enactment and enforcement of zoning and subdivision controls, building and housing codes and safety regulations.

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[illegible]

4. Consideration of physical, social, economic and governmental conditions and trends including, but not limited to local, regional and state studies of the human resource, education, health, housing, recreation, social services, public utilities, public protection, transportation, cultural and inter-personal communication needs of the municipality.

5. The protection of existing and potential public and ground drinking water supplies.

6. Energy efficient patterns of development, the use of solar and other renewable forms of energy and energy conservation.

7. The commission may prepare and adopt plans for the redevelopment and improvement of districts and neighborhoods which in its judgment contain special problems or show a trend toward lower land values.

8. The commission may use soil survey maps of the Soil Conservation Service as a standard in determining land use.

Adoption Of The Plan:

1. The commission may adopt the plan by a single resolution or by successive resolutions adopt parts of the plan.

2. Prior to adoption, the commission shall file in the office of the town clerk a copy of the plan or amendments thereto.

3. The commission shall hold at least one public hearing concerning the plan. Notice of the public hearing shall be published in a newspaper having general circulation in the municipality at least twice at intervals of not less than two days, the first not more than fifteen days nor less than ten days and the last not less than two days prior to the hearing date.

4. Upon adoption by the commission the plan shall be filed in the office of the town clerk.

5. The plan shall become effective at a time established by the commission provided notice thereof is published in a newspaper having a general circulation in the municipality prior to such effective date.

Significant Court Rulings:

1. Master plan is controlling as to municipal improvements but merely advisory as to zoning.

2. Plan of development is of broader significance than zoing and the two terms are not interchangeable. Planning denotes systematic development of municipality while zoning is concerned primarily with use of property.

3. Recommendations in the plan of development designating appropriate uses for various areas in town is merely advisory and does not bind zoning commission.

JG/mab
3/12/84

THE UNIVERSITY OF CONNECTICUT
Cooperative Extension Service
AGRICULTURE HOME ECONOMICS 4-H COMMUNITY RESOURCE DEVELOPMENT

MIDDLESEX COUNTY EXTENSION OFFICE
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# MAJOR COMPONENTS OF A MODEL PLAN OF DEVELOPMENT

By Jim Gibbons
Cooperative Extension
Community Resource Development Agent

A. Introduction
  1. Legal Basis for Plan of Development
  2. Reasons for Updating Plan
  3. Planning Process
  4. Intent of the Plan

B. Population
  1. Past Trends
  2. Current Population Characteristics
  3. Projections

C. Housing
  1. Total Housing Stock - Characteristics
  2. Age of Housing Stock
  3. Building Permits and Certificates of Occupancy

D. Economic Development
  1. Employment Characteristics
  2. Commercial and Industrial Property
  3. Resident Attitudes On Commercial and Industrial Development

E. The Environment
  1. Physical Characteristics and Setting
    a. Geographic Setting
    b. Topography
    c. Geological Characteristics
      - Bedrock Geology
      - Surficial Geology
    d. Drainage Basins
    e. Surface Water - Quality
    f. Groundwater - Quality
      - Bedrock Aquifers
      - Unconsolidated Deposits

  2. Environmentally Sensitive Areas and Natural Resource Preservation
    a. Inland-Wetlands and Watercourses
    b. Flood Hazard Areas
    c. Soils With Limitations For Development
    d. Potential Aquifers and Recharge Areas
    e. Agricultural Lands
    f. Prime Forest Lands
    g. Open Space
    h. Recreation Areas

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F. Community Facilities
    1. Town Hall
    2. Police
    3. Fire - Emergency Medical
    4. Library
    5. Public Schools
    6. Waste Disposal
    7. Public Utilities
        a. Water
        b. Sewer
        c. Electrical
        d. Major Utility Rights-of-Way

G. Transportation
    1. Road Classification
    2. Travel Patterns
    3. Road Deficiencies - (Volume and Accidents)
    4. Mass Transportation

H. Historic Preservation
    1. Structures on National or State Register
    2. Districts

I. Existing Land Use
    1. Land Use Inventory
        a. Residential
        b. Commercial
        c. Industrial
        d. Utilities
        e. Institutional
        f. Public
        g. Agricultural
        h. Forest
        i. Open Space and Recreational

J. Proposed Land Use
    1. General Goals and Objectives
    2. Residential Land Use
    3. Commercial Land Use
    4. Industrial Land
    5. Public and Quasi Public Land and Facilities
    6. Agricultural
    7. Forest
    8. Open Space and Recreation
    9. Transportation and Roads
    10. Historic Preservation

K. Community Attitudinal Survey

JG/lbd
3/19/84

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## SUGGESTIONS TO IMPROVE THE PLAN OF DEVELOPMENT PLANNING PROCESS

By Jim Gibbons
Cooperative Extension
Community Resource Development Agent

- Determine what is wrong with your town's existing plan of development. Is it outdated or lacking key natural resource data? What are its good points? Many plans contain excellent recommendations that have never been implemented by administration.

- Don't confuse zoning with planning recommendations. A plan should provide a blueprint for zoning regulations but does not always have to be the same as zoning.

- Ask local commissions or officials to review the existing plan and comment on its worth. Ask a professional planner to do the same. Maybe just one or two chapters need revision rather than a major update of the whole plan.

- If it is decided to update the plan, set up a sub-committee with people willing to put in a lot of work. The sub-committee may contain volunteers who are not members of the Planning Commission.

- Community planning has been taking a backseat to subdivision review and on a combined commission, to zoning matters. It is often necessary to schedule special meetings where the plan is the only agenda item or devote a major segment of regularly scheduled meetings for plan discussion.

- A plan of development takes time to prepare. Realistically a planning commission is looking at a two or three year project. Develop a "draft" timetable for the planning process but don't panic if the time schedule is not followed. A good plan has considerable public input and public participation takes time.

- Ask planners or other commissions for copies of plans they think are well done. Review these plans and compare them to your town's plan.

- Seek assistance from public agencies with staff knowledgeable about land use planning or natural resources. Agencies such as the UConn Extension Service, the Soil Conservation Service, Department of Environmental Protection, Regional Planning Agencies, etc., are excellent sources.

- It may be necessary to hire an outside consultant to do the plan. Before seeking outside assistance determine specific areas where help is needed, i.e. map preparation, data compilation. It might not be necessary to hire a consultant to do the whole plan but only portions thereof. The commission might also consider hiring its own full-time or part-time planner at this time.

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- Get the community involved early in the planning process. Ask other town commissions and agencies to review applicable sections and rewrite as needed.

- Keep other commissions informed of the plan's progress. Have planning commission members attend meetings of those boards to report on the plan.

- Develop a slide presentation on the plan that commission members can use to address service clubs, commissions, senior citizen clubs, etc.

- Ask newspaper reporters to do a feature article on the plan of development and its implications for the future growth of the community.

- Hold several informal informational meetings to educate the public on the plan.

- Don't waste time and effort on detailed studies or maps that do not directly influence plan recommendations, i.e. public finance. Many sections of plans prepared in the 1950s and '60s were done as a requirement to obtain federal funds.

- Don't overemphasize any one factor to the detriment of others. For instance, natural resource protection must be weighed against land use trends and economic development before final recommendations are made.

- Place maps on transparent material to allow overlay analysis.

- Realize the plan can't accomplish everything so compromise is required and priorities must be set. For example, in order to achieve farmland preservation, it is important to harmonize that effort with the need to build housing units. A compromise might be to establish cluster housing and use the resulting open space for farming.

- Good material developed for the plan can be used in the commission's everyday work. For instance, maps showing areas with soils having limitations for urban uses can and should be referred to during subdivision review. Keep planning maps posted so they can easily be used.

- Conduct a Community Attitudinal Survey to gain public involvement and to test reaction to the commission's preliminary ideas. The survey can also be a great public relations tool as merchants and town offices can be asked to participate as collection points, etc.

- Make copies of the draft plan and maps readily available for public view at the library, town hall, or other areas where the public gathers.

- Hold several public hearings rather than try to cover the whole plan in one session. Leave plenty of time for questions and comments.

- If professional assistance is used to develop the plan, limit their involvement at the public hearing. The general public wants to hear its own commission make the presentation not an outside expert. This also forces the commission to become very knowledgeable about the content of the plan.

- Don't let your plan collect dust. Refer to it when major community decisions are being made. Update it periodically so the commission is not overwhelmed with the task of a major rewrite.

- Develop a Capital Improvement Budget to implement plan recommendations and update it each year with other municipal agencies.

JG/bhb
3/20/84

## DESCRIPTIONS OF OVERLAY MAPS USED IN GROUND WATER PROTECTION PLANNING PROCESS

1. CONSERVATION AREAS: This map shows the location of state and federally owned lands; natural areas registered by the DEP; state designated wildlife management, wildlife habitat and fish and game areas; natural area preserves; boating, swimming and fishing areas; streams and lakes managed for cold water and anadromous fisheries; and shellfish concentration areas. To this base towns can add municipal and private open space, water company owned lands and other land or water areas essentially removed from development or deemed of high value in their present state, such as historic districts, archeological sites, wetlands, flood plains or prime farm land soils. Two or more overlays may be necessary to show all this information.

2. DRAINAGE BASINS: This map depicts the natural boundaries of surface and ground waters. The lines follow the points of highest elevations which surround a particular surface water river, stream or brook. Also known as "catchment areas," this map shows how rainwater is captured within a discrete land area and the surface runoff and ground waters are collected into surface water courses which join together to exit from the lowest point in a basin, the outlet. Refer to the large scale map entitled "Natural Drainage Basins in Connecticut" for an explanation of the major, regional and subregional basin terminology.

3. LAND USE CHARACTER BY RISK: Depicts land use types and rates them by their risk to ground water quality. Class A uses pose the least risk, Class E the most. Existing land uses should be mapped, not the entire areas zoned for such uses. Refer to Appendix A of "Protecting Connecticut's Ground Water" for a listing of land uses and their relative ground water quality risk.

4. PLAN OF DEVELOPMENT: An overlay which depicts a town's future. It should agree with the zoning map, or at least include existing land use types in each zone and may show future expansion of those zones. It may depict certain desirable land use goals such as; proposed or potential sites for high density residential development, certain types of commercial centers, heavy or light industry, open spaces and future municipal facilities such as schools, parks, office buildings and town garages.

5. STATE PLAN OF CONSERVATION AND DEVELOPMENT: This document, produced by the State's Office of Policy and Management, details state policy onland use. Attached to this book is a colored "Locational Guide Map" at a scale of 1:250,000 (1"=4 miles). Towns should review this map, determine the reason why their community is colored as it is and whether the local zoning and plan of development maps agree with the state's guide map.

6. STRATIFIED DRIFT: This map depicts those areas featured by deposits of outwash sediments. Basically, when the last glacier melted (12,000 years ago), sand and silt laden rivers poured over the landscape, depositing sediments in hollows and river valleys. This stratified (layered) material can be either fine grained (silt and clay), coarse grained (sandy) or a mixture of the two. Deep deposits of coarse grained material with more than forty feet of saturated thickness (high water supply potential), may be present within some of the larger areas of stratified material.

7. WASTE DISPOSAL SITES & SERVICE AREAS: The location of point source wastewater discharges to streams, the sites of oil spills and leaks, landfills and junk yards are shown on this overlay as would be the area of town served by municipal sewers. Refer to the state's "Leachate and Wastewater Discharge Sources Map" for more detail.

8. WATER QUALITY: Depicts where the surface and ground waters are clean or contaminated, how they are being used (for water supply or waste disposal) and the state's water quality goal for all these waters. If a classification is in two parts, such as ground waters designated as GB/GA, the first part indicates the present condition and the second part, the State's water quality and water use goal. Refer to the "Water Quality Standards" for a more complete description of these classes.

9. WATER SUPPLY SOURCES AND SERVICE AREAS: Locates public water supply reservoirs & wells, and geographic area served by these supply sources. Non-community public drinking water wells (those serving schools, factories, office buildings and commercial centers) may also be located, if desired, to show other sites of concentrated ground water use.

10. ZONING: This overlay shows existing and potential land use types. The three major categories shown should be; residential (high, medium, low and/or single family or multi-family), commercial (trades and services), industrial (manufacturing and processing). Agricultural lands and open space areas are not zones but rather specific land uses which are usually allowed as of right in almost all zones so they should not appear on a zoning district map (flood prone areas and wetlands likewise are natural topographic conditions, not land use zones).

11. OPTIONAL OVERLAYS: Using soil maps, show (1) soil suitability for septic systems, (2) steep slopes, (3) suitability for development, (4) Lands taxed as open space, forestland, farming; and (5) areas or sites used for resource extraction (gravel pits, quarries) and lands in active agriculture.

November 1986

Principal hydrogeolgic units: properties, water quality, and susceptibility to contamination (From Handman and other, 1979, p. 12)

| Hydrogeologic Unit | Physical Characteristics and Distribution | Water-bearing Properties | Background quality of Ground Water | Susceptibility Contamination |
|---|---|---|---|---|
| UNCONSOLIDATED SEDIMENTS | | | | |
| Stratified drift (coarse) | Fine to coarse sand with some silt and gravel; deposits well sorted and stratified. Occur in streams valleys and lowlands. Commonly interbedded with finer layers. Overlie till and bedrock. | Most productive aquifers in State; especially where thick, coarse grained, and hydraulically connected to large streams or lakes. Provide large yields for public-supply and industrial uses. | Low dissolved-solids concentration. Generally moderately hard, especially where constituent fragments or underlying bedrock consist of carbonate rocks. Local high concentrations of iron and manganese. | Highly susceptible because of high hydraulic conductivity, proximity of water table to land surface, extensive cones of depression in heavily pumped areas, use of abandoned sand and gravel pits as dumps, and because of location in larger valleys, many of which are urbanized and industrialized. |
| Stratified drift (fine) | Predominantly clay, silt, and very fine sand; deposits well sorted. Occur in streams valleys and lowlands. Commonly interbedded with coarser layers. Overlie till and bedrock. | Poor aquifers, particularly where very fine grained and not interbedded with coarse layers. | Same as coarse-grained stratified drift. | Less susceptible than coarse-grained stratified drift because of its lower hydraulic conductivity. |
| Till | Heterogeneous mixture of unstratified materials ranging in size from clay to boulders; generally compact; commonly called "hardpan." Overlies bedrock in most of the State. | Poor aquifers, especially where hydraulic conductivity is low and saturated section is thin. Can provide small supplies to dug wells of large diameter. | Low dissolved-solids concentration. Generally soft to moderately hard. Local high concentration of iron and manganese. | Less susceptible than stratified drift because of its low hydraulic conductivity, but dug wells are subject to contamination from local sources. |

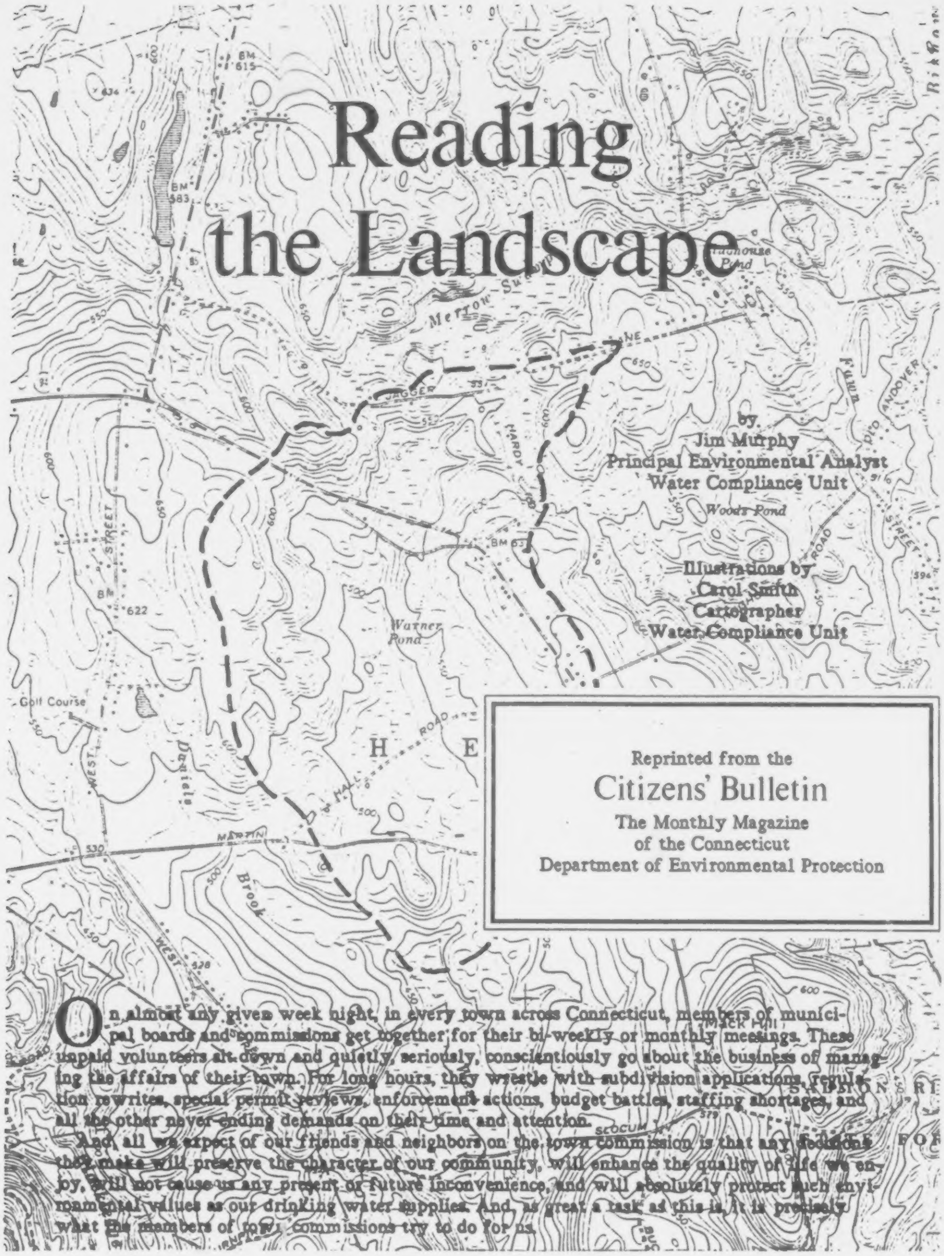
BEDROCK

| | | | | |
|---|---|---|---|---|
| Sedimentary (and associated igenous) rocks | Sedimentary aquifers are fine-to-coarse-grained bedded rocks (shale, sandstone, siltstone, and conglomorate); joints well defined. Underlie most of central Connecticut. Associated igneous rocks are basalt and diabase(trap rock)flows separated by sedimentary rocks, joints well defined. Form ridges in central Connecticut. | Yields adequate supplies for domestic and small-scale municipal and industrial purposes from openings along bedding planes and joints. | Moderate dissolved-solids concentration, generally moderately hard to hard. High dissolved sulfate, chloride, and sodium concentrations locally. Significant chemical quality differences, both areally and with depth. | Contaminants can enter along joints and bedding surfaces, especially where covering of till or other unconsolidated deposits is thin. Sedimentary rocks in lowlands susceptible because of urban and industrial land uses. |
| Carbonate rocks | Calcium and magnesium carbonate (limestone, dolostone and marble). Underlie a few valleys in western part of State. | Provide adequate supplies for domestic and small-scale municipal and industrial purposes. | Moderate dissolved-solids concentration, generally hard; most supplies require softening. Commonly alkaline and low in iron and manganese. | Susceptible where intensively and deeply weathered, as in parts of southwestern Connecticut and where covering of till or other unconsolidated materials is thin. Solution channels facilitating movement of contaminants are rare. |
| Crystalline (noncarbonate) rocks | Predominantly metamorphic rocks (schist and gneiss), highly folded, numerous joints. Underlie most of eastern and western Connecticut; overlain by thin till in most places. | Yield adequate supplies for domestic use to drilled walls, from openings along joints. | Low dissolved-solids concentration, soft to moderately hard, locally hard, local high concentrations of iron and manganese. | Contaminants can enter along joints and other fractures, especially where covering of till or other uncon- deposits are thin. |

# Reading the Landscape

by
Jim Murphy
Principal Environmental Analyst
Water Compliance Unit

Illustrations by
Carol Smith
Cartographer
Water Compliance Unit


Merrow Swamp
Warner Pond
Woods Pond
Golf Course
Daniels Brook
Mack Hill
Slocum
Martin
Hardy
Dagger
West Street
Hall Road
Old Andover
BM 615
BM 583
BM 622
634
650
600
550
530
500

Reprinted from the
Citizens' Bulletin
The Monthly Magazine
of the Connecticut
Department of Environmental Protection

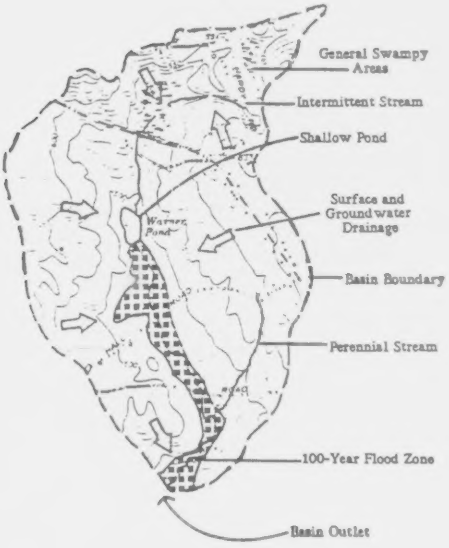
On almost any given week night, in every town across Connecticut, members of municipal boards and commissions get together for their bi-weekly or monthly meetings. These unpaid volunteers sit down and quietly, seriously, conscientiously go about the business of managing the affairs of their town. For long hours, they wrestle with subdivision applications, regulation rewrites, special permit reviews, enforcement actions, budget battles, staffing shortages, and all the other never-ending demands on their time and attention.

And all we expect of our friends and neighbors on the town commission is that any decisions they make will preserve the character of our community, will enhance the quality of life we enjoy, will not cause us any present or future inconvenience, and will absolutely protect such environmental values as our drinking water supplies. And, as great a task as this is, it is precisely what the members of town commissions try to do for us.

It is the purpose of this article to assist land use managers to achieve the goals they have set for themselves and for their towns. This can be done by achieving a broader awareness of a town's natural features, to include wetlands, floodplains, and groundwater. In this article, then, we would like to do two things: first, we will take an in-depth look at one small area of our state in terms of the dynamic interrelationship of its natural resources; and second, we will show how local officials can use this broader perception in making management decisions and evaluating potential land use impacts.

A town's waters, land features, plants, and animals do not follow political boundaries. Rather, they result from the dynamic interrelationship among natural processes. If we can achieve a clear perception and visualization of that overall organization, then land use decisions will be more informed, consistent, and effective.

Figure 1
Major Drainage Features

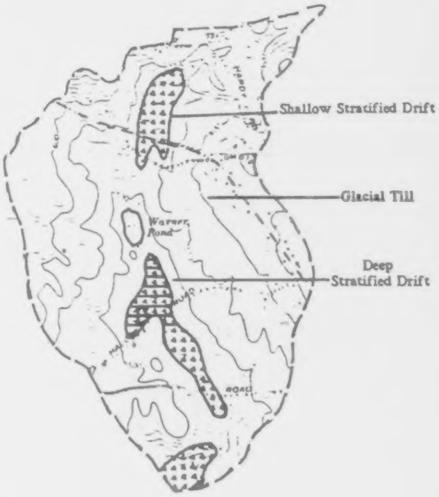


One approach to visualizing that natural organization is through the use of drainage basins. Figure 1 shows a typical small basin, the basic hydrologic land unit in which precipitation is collected. Rain which falls in the basin may take two courses: It may either run over the land and quickly enter surface watercourses, or it may soak into the ground, slowly moving through the earth until it surfaces in a wetland or stream. In a drainage basin, the surface and groundwater arrive as precipitation and leave either by evaporation or as surface runoff from the basin's outlet. A basin is a self-contained hydrologic system, with a clearly-defined water budget and cycle. Water in equals water out — the pathways are predictable.

In Figure 1, the obvious surface water features are the streams and the pond. Some streams flow only after heavy rains and during spring melt, and are termed "ephemeral." Others, which flow all year long, are called "perennial." During the warmer, drier summer months, the major portion of a stream flow will come from seepage of ground waters into streams. Warner Pond is the only permanent large water body in the basin. It is a natural, shallow, warm water pond. It provides habitat for warm water fish species, such as bass and perch.

As we know, our New England climate is variable and occasionally fierce. Periodically, major storms deposit uncommon quantities of rain, causing severe flooding. The most fearsome are the "100-year storms." Areas in the basin where these storms may be expected have been mapped. The "flood zones" are quite clearly high-risk basin segments. Figure 1 shows that risk area for this basin.

Figure 2
Basin Surficial Geology



Now, having neatly bundled the landscape into workable pieces and figured out the plumbing, we can next look at other major basin components. Dominating the area are the physical earth materials from which soils are created. Figure 2 depicts the two basic surficial geologic forms in this basin: the *glacial till*, a mixture of rock and smaller-sized materials which was spread over the bedrock (ledge) by the advance and retreat of glacial ice about 15,000 years ago; and the *stratified drift*, sand and gravel material washed into hollows and valleys as the ice sheet melted away.

These two types of earth conduct water at different rates. Till, or hardpan, is usually less than 15 feet thick, is firmly pressed onto the landscape, and is poorly suited for water supply development because it transmits water very slowly. Stratified drift, on the other hand, is usually just the opposite of glacial till, being permeable and porous. These deposits can be important water sources if they are deep and have a coarse-grained texture, such as the area just south of Warner Pond.

Most people are familiar with the concept of soil type and how different soils are shown on maps. Figure 3 consolidates the many basin soils into two major types, the *upland till soils* and the *lowland outwash soils*.

Basically, the *upland till soils* are in three groups: 1) the thinly-soiled, dry, rocky areas, where the advancing glacier scraped almost all the earth off the bedrock; 2) the tight, wet soils formed in material which was compressed at the base of the advancing ice sheet (termed basal till, or hardpan) and was pressed onto broad ridgelines; and 3) the looser, friable, and drier glacial debris dumped onto hillsides by the melting ice sheet.

The *lowland outwash soils* can also be grouped into three types: 1) the drier terrace soils formed in sand, and gravels washed into valleys by melt-waters; 2) the wet floodplain soils along water courses, periodically inundated following heavy rains; and 3) the soggy marsh and swamp soils formed in wet depressions.

This grouping helps to determine the origins of a soil group, the general physical structure of these soils, and how wet or dry we could expect to find an area. These conditions should be taken into account when evaluating the potential impact of a development, or when making long-term land and water use plans.

Figure 3
Natural Soil Groups

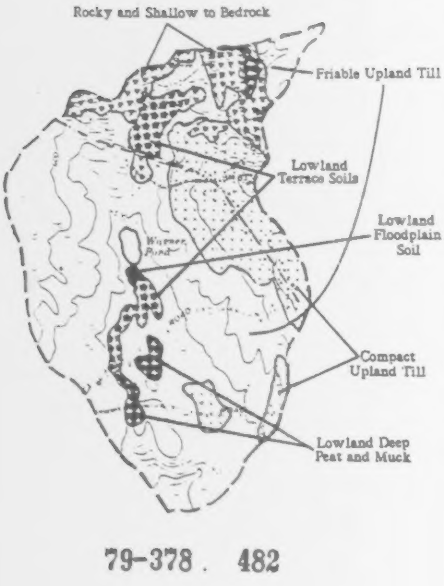
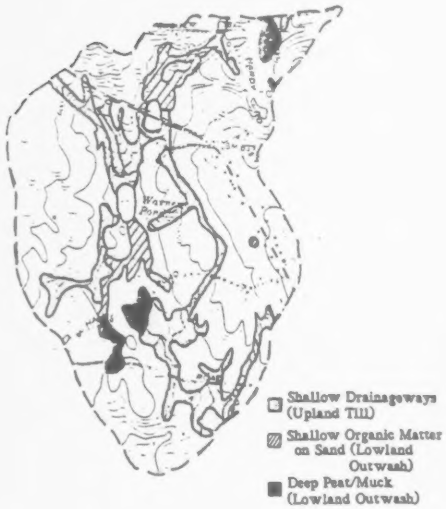

Rocky and Shallow to Bedrock
Friable Upland Till
Lowland Terrace Soils
Lowland Floodplain Soil
Compact Upland Till
Lowland Deep Peat and Muck
Warner Pond

Figure 4
Wetlands Defined By Soil Type


Warner Pond
☐ Shallow Drainageways (Upland Till)
▨ Shallow Organic Matter on Sand (Lowland Outwash)
■ Deep Peat/Muck (Lowland Outwash)

Wetlands are significant features within any basin. Connecticut law defines inland wetlands in terms of soil drainage class — as either poorly drained or *very* poorly drained — and by the position of soils within a basin — as either alluvial or floodplain. Utilizing the soil grouping shown in Figure 3, we can classify the basin's wetland soils into two types: the ***upland till wetland soils*** and the ***lowland outwash wetland soils***. Figure 4 depicts that grouping and tells us that not only are the wetlands physically different, they also perform different hydrologic functions in this basin.

The ***upland till wetlands*** appear to be acting as hydraulic conduits, collecting and channeling surface runoff. Water entering these wetlands doesn't remain long, because this wetland type is found on the sides of hills, the soil is made up of relatively impermeable glacial till, and physically, the wetland has the form of a narrow chute.

The ***lowland outwash wetlands***, on the other hand, appear to act as natural catch basins in which water can spread out during heavy rains. Water entering these wetlands may be detained because the wetland occupies low-lying areas and depressions, the soil may contain a large amount of water-absorbing organic matter and, physically, the wetland has the form of a broad, flat plain.

Wetlands, then, have both structural and functional differences; they are not all just wetland soils. Understanding a particular wetland's role in basin hydrology is useful, such as when a local agency is reviewing a proposal to fill all or part of a wetland. An understanding of the upstream and downstream consequences of that filling will help maintain the function of the basin's hydrologic system components. What should be clear to managers, then, is that a change in one component of a basin's hydrologic system can be expected to impact all other components.

We have now looked at this basin's geology, soils, and hydrologic features. There are, of course, plants and animals here that we should also be aware of. Further, it is quite possible to depict the extent of forest and fields, or to subdivide the woodlands by age, size, or species composition (hardwoods, softwoods, or a mixture of the two).

There are other natural characteristics within the basin which we could identify and map. We could locate rare and endangered species habitats, unique plant communities, locations of caves, cliffs, ravines, springs and water falls, and, of course, the best fishing holes. As an example, we will show how this can be done with just one of the basin's biological communities.

**Figure 5**
**Wetland Vegetation Types**

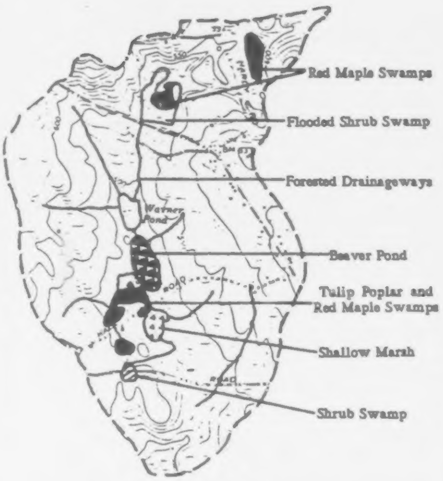


Figure 5 shows the wetland vegetation types identified through the national wetland inventory program. In this small basin, it is apparent there are several wetland groupings which represent not only unique plant communities, but also hint at the location of different animal populations. This inventory reveals the natural diversity that is possible in even relatively small land areas. The abundance and variety of these and other natural features lend a unique character to any landscape.

Almost all the information described above, for any area of the state, is available from the DEP and from local naturalists who may now be members of a local conservation organization. All that is really needed to make the fullest use of this information is to bring it all together in a usable form.

We recommend local conservation and land use commissions construct maps similar to those in this article. This effort will result in not only a new data base for a community, but can also bring about a broader, dynamic perception of the local landscape.

No governmental body can guarantee its every decision. Some decisions, no matter how well-informed, may cause some unforeseen environmental impact. On the other hand, minimizing these impacts is a reasonable and attainable goal. The first step in that direction must be the clear perception of what's out there that we want to protect. We hope this article will serve as a beginning in reaching that goal. ■

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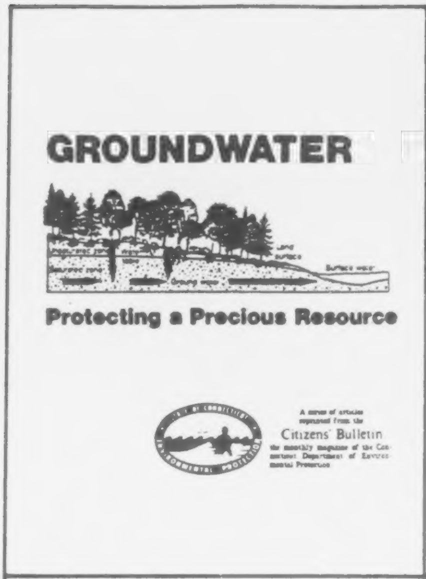

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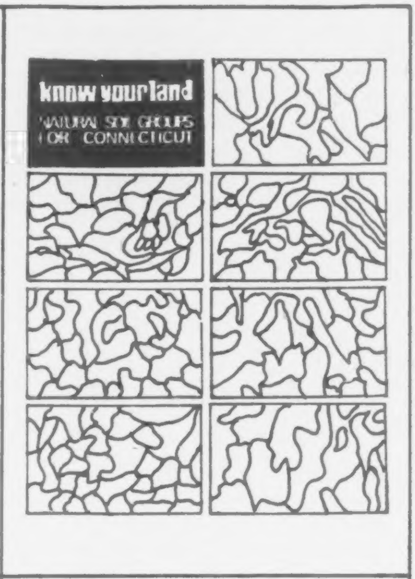
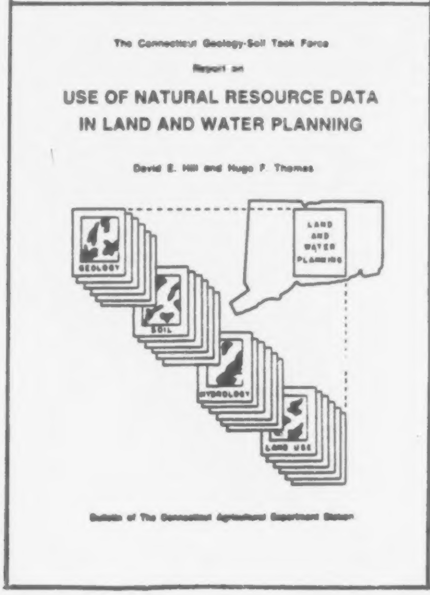
Surface water
Ground water



know your land
NATURAL SOIL GROUPS
FOR CONNECTICUT



The Connecticut Geology-Soil Task Force

Report on

USE OF NATURAL RESOURCE DATA
IN LAND AND WATER PLANNING

David E. Hill and Hugo F. Thomas

Bulletin of The Connecticut Agricultural Experiment Station

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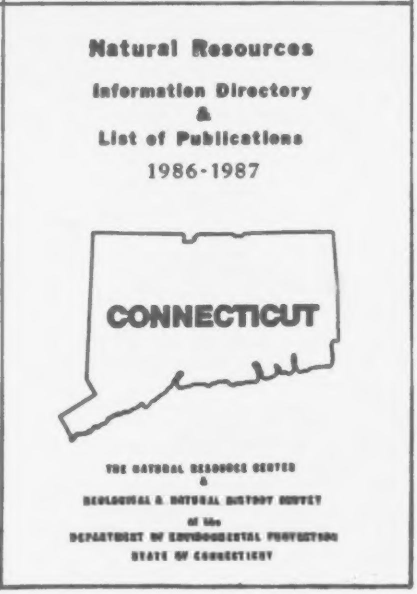

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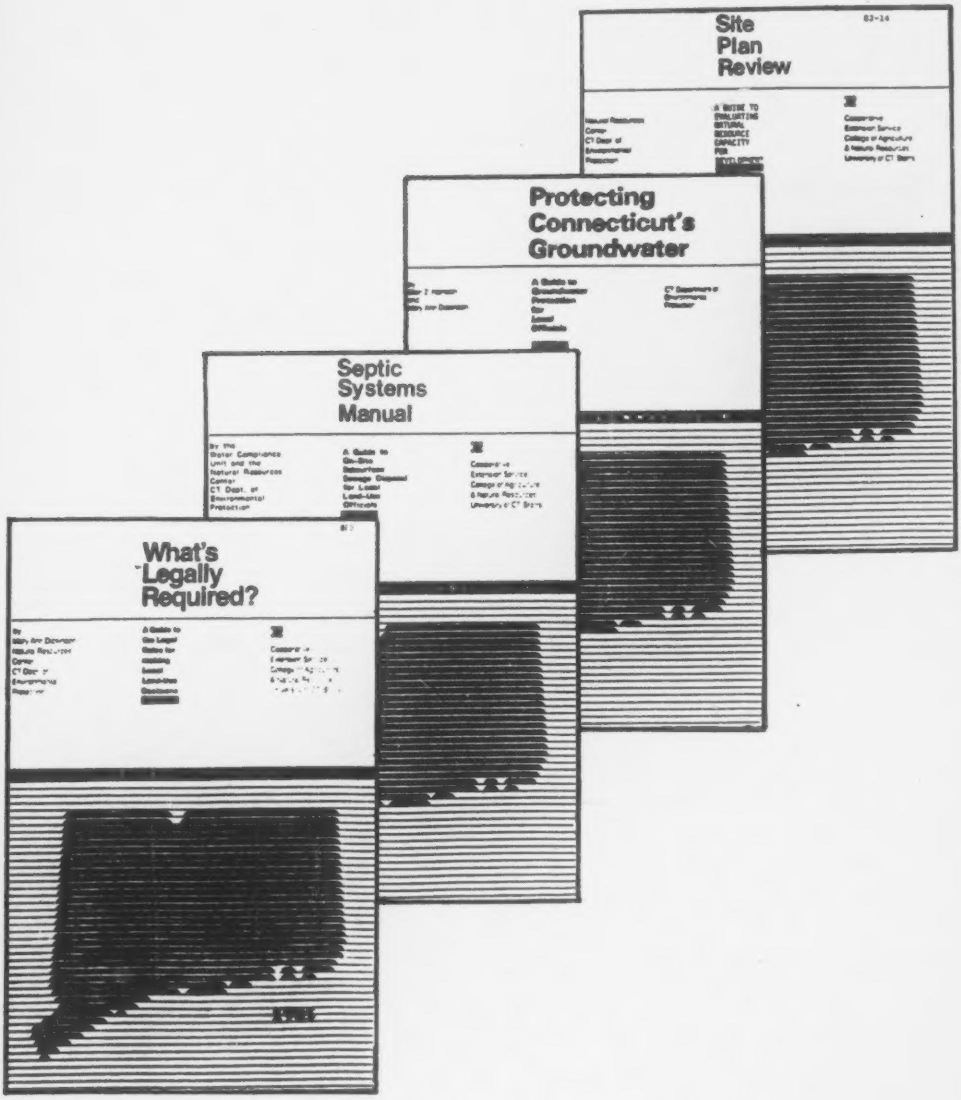

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Natural Resources Center
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A Guide to Groundwater Protection for Local Officials

CT Department of Environmental Protection

Septic Systems Manual

By the Water Compliance Unit and the Natural Resources Center
CT Dept. of Environmental Protection

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CT Dept. of Environmental Protection

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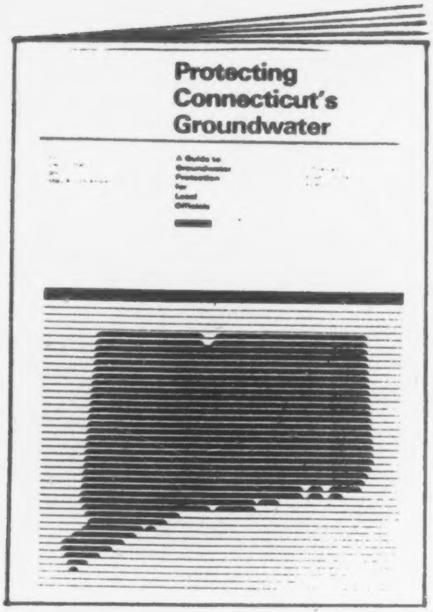
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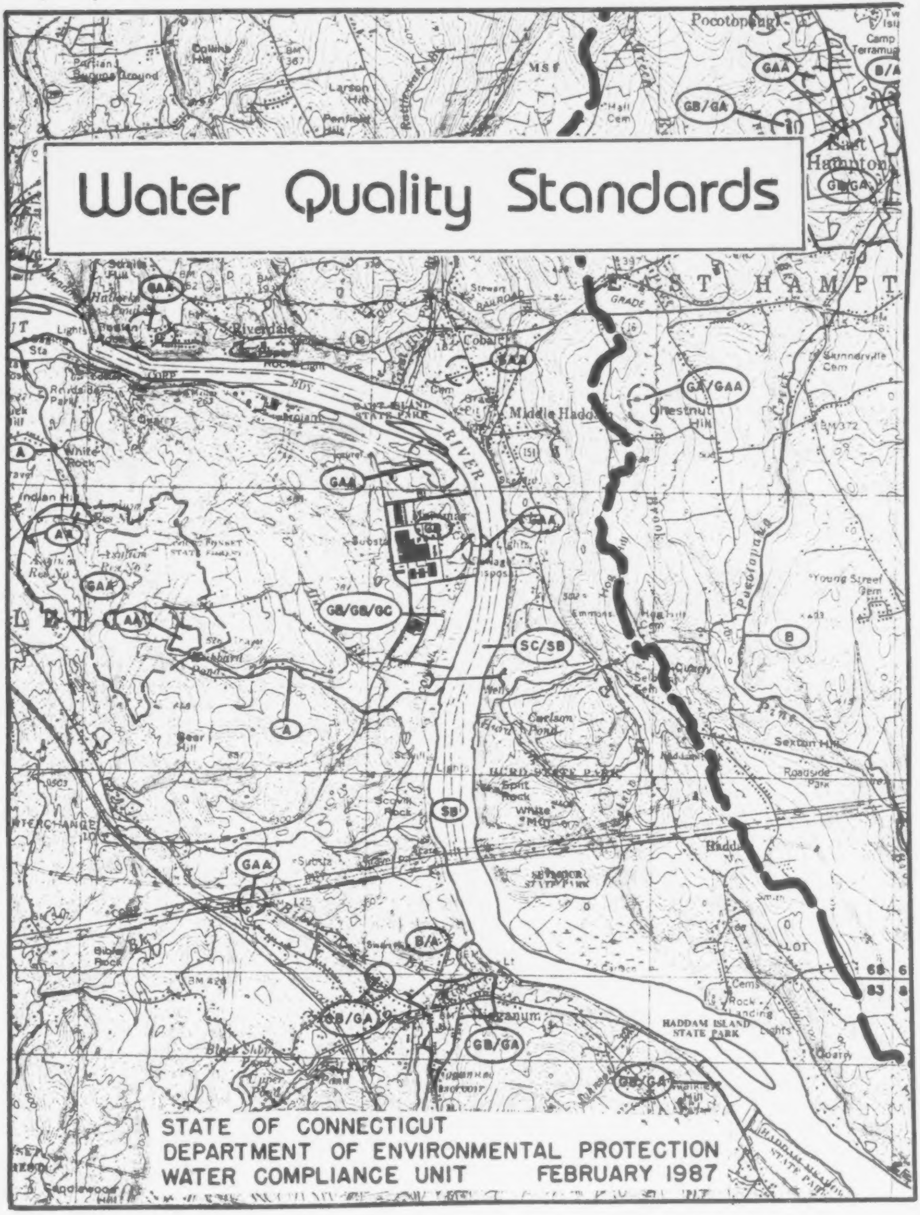
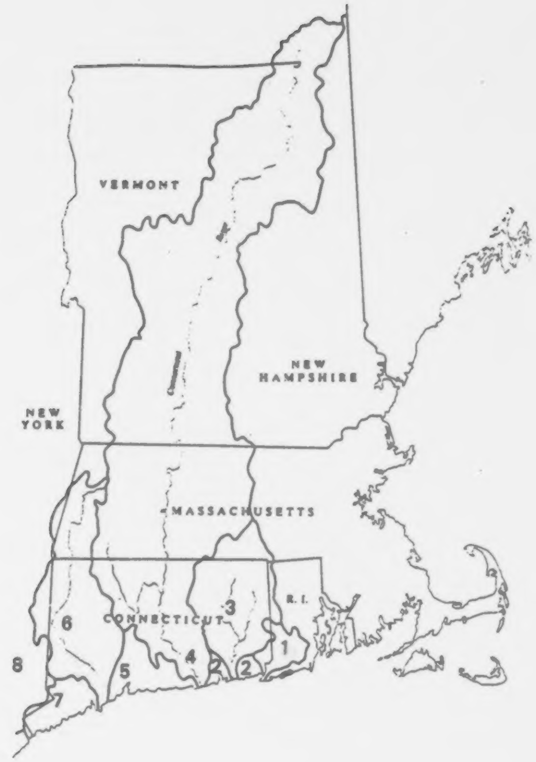


# Water Quality Standards

STATE OF CONNECTICUT
DEPARTMENT OF ENVIRONMENTAL PROTECTION
WATER COMPLIANCE UNIT FEBRUARY 1987

Pocotopaug
GAA
B/A
GB/GA
East Hampton
EAST HAMPT
GA/GAA
Middle Haddam
Riverdale
RIVER
GAA
AA
A
GB/GB/GC
SC/SB
B
Carlson Pond
HURD STATE PARK
SB
Haddam
HADDAM ISLAND STATE PARK
B/A
GB/GA
Higganum


VERMONT
NEW HAMPSHIRE
NEW YORK
MASSACHUSETTS
CONNECTICUT
R. I.
1
2
2
3
4
5
6
7
8

MAJOR DRAINAGE BASINS IN CONNECTICUT

1 Pawcatuck Major Basin
2 Southeast Coast Major Basin
3 Thames Major Basin
4 Connecticut Major Basin
5 South Central Coast Major Basin
6 Housatonic Major Basin
7 Southwest Coast Major Basin
8 Hudson Major Basin

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# WATER QUALITY STANDARDS

## I. INTRODUCTION

Section 22a-426 of the Connecticut General Statutes requires the Commissioner of Environmental Protection to adopt standards of water quality for all the State's waters. The purpose of these standards is to provide clear and objective statements for existing and projected water quality and the general program to improve Connecticut's water resources. They also serve to qualify the state and its municipalities for available federal grants for water pollution control.

State statute mandates that these standards shall:

(1) Apply to interstate waters or portions thereof within the State.
(2) Apply to such other waters within the state as the Commissioner may determine is necessary.
(3) Protect the public health and welfare and promote the economic development of the State.
(4) Preserve and enhance the quality of State waters for present and prospective future use for public water supplies, propagation of fish and aquatic life and wildlife, recreational purposes and agricultural, industrial and other legitimate uses.
(5) Be consistent with the health standards as established by the Department of Health Services.

Water Quality Classifications, based on the adopted Water Quality Standards (WQS), establish designated uses for surface and ground waters and identify the criteria necessary to support those uses. The designated use and criteria goals serve to focus the department's water quality management activities, including establishment of water quality based treatment controls and strategies required by Sections 301 and 306 of the Federal Clean Water Act.

Section 303 of the Federal Clean Water Act requires state adoption of surface water quality standards and their review and modification at least every three years. Federal law defines water quality standards as the identification of water quality goals of a waterbody through the assignment of designated uses to be made of the water and by setting criteria necessary to protect the uses.

Federal regulations state water quality standards should, wherever attainable, provide water quality for the protection and propagation of fish, shellfish and wildlife and for recreation in and on the water and take into consideration their use and value of public water supplies, propagation of fish, shellfish and wildlife, recreation in and on the water and agricultural, industrial and other purposes including navigation.

Though federal law requires adoption of water quality standards for surface waters, ground waters are not subject to federal review and approval. Connecticut's water quality standards however, recognize the inter-relationship between surface and ground waters and the competing use of ground waters for drinking and for wastewater assimilation. These standards specifically identify ground water quality goals, designated uses and those measures necessary for protection of public and private drinking water supplies; the principal use of Connecticut's ground waters.

## II. SURFACE WATERS STANDARDS

1. It is the State's goal to restore or maintain surface waters to a quality consistent with their designated use and supportive quality criteria goals.

2. Surface waters with a classification goal of B or SB and with existing quality better than established standards for that Class will be maintained at their existing high quality. The Commissioner may require of discharges permit applicants a minimum level of treatment exceeding the applicable standards of performance for new sources promulgated pursuant to the federal Clean Water Act as well as Sections 22a-430 and 22a-436 of the Connecticut General Statutes or other special treatment requirements deemed necessary to prevent pollution and which will maintain existing uses made of, or presently possible in such waters.

3. All surface waters receiving treated wastewater discharges under permit will be restored and maintained to a condition consistent with Class B or Class SB designated uses and quality criteria except where irreperably altered to the extent certain designated uses have been permanently lost. The determination of where these exceptions exist shall follow federal EPA "Use Attainability" guidance and shall be subject to approval of the Commissioner and of the federal Environmental Protection Agency (EPA).

4. Surface waters will not be lowered in a designated use goal as established by its classification unless, and until it has been demonstrated to the Commissioner that such change is justifiable due to overriding economic or social needs and will not interfere with or become injurious to any existing uses made of, or presently possible in, such waters. Any applicant requesting a change in a water quality classification will be required to demonstrate to the Commissioner the proposed new Class designation is consistent with all such uses.

5. Discharges to surface waters shall be limited as follows:
   (A) Class AA surface waters: discharges may be permitted by the Commissioner from public or private drinking water treatment systems, minor cooling and other clean water discharges, subject to the approval of the Commissioner of Health Services. Backwash discharges must be treated to a level which in the judgement of the Commissioner of Environmental Protection protects aquatic life and drinking water supplies.
   (B) Class A and SA surface waters: discharges may be permitted by the Commissioner of treated backwash waters from public or private drinking water treatment systems, minor cooling and other clean water discharges.
   (C) Class B and SB surface waters: discharges may be permitted for all those allowed in Class AA, A and SA waters, for major cooling water discharges and major and minor discharges from municipal and industrial wastewater treatment systems.
   (D) The designation of surface waters as Classes C/B, D/B, SC/SB or SD/SB, shall not be a reason for authorizing a new discharge that would not allow the receiving surface waters to attain Class B or Class SB designated uses and quality criteria.

(E) The designation of surface waters as Classes B/AA, B/A, C/A, SB/SA, or SC/SA shall not be a reason for authorizing a new discharge that would be inconsistent with Class AA, A or SA discharge limits.

6. The Commissioner may establish zones of influence when permitting discharges to surface waters. The spatial dimensions and/or volume of receiving water allocated to zones of influence will be established on a case-by-case basis, taking into account the unique hydraulic, physical/chemical, and biological characteristics of the receiving waterbody. The intent is to allow the Commissioner to allocate a portion of the receiving water resource for mixing and assimilation of a discharge effluent provided this zone of influence will not preclude any designated uses of the receiving waterbody. The Commissioner, pursuant to statutory authority, may require surface water dischargers to provide information on receiving water characteristics including the spatial dimensions of the discharge zone of influence and the volume of flow required for mixing and assimilation of waste. Considerations to be used in establishing zones of influence include:
   (a) The volume, strength, and persistence of any toxic substances in the discharge effluent, as well as potential bioaccumulation of toxic substances in aquatic organisms.
   (b) Allowance for a continuous zone of passage for free swimming and drifting organisms.
   (c) Impingement upon spawning grounds and nursery areas for sensitive aquatic organisms or areas utilized by aquatic organisms for shelter and living space to the extent that the environmental value of the receiving waterbody is significantly reduced.
   (d) The location of other discharges to the receiving waterbody to insure that the cumulative effect of adjacent zones of influence will not significantly reduce the environmental value of the receiving waterbody.

   Assessment of environmental value will be based on a number of receiving water characteristics, including but not limited to: type of waterbody, velocity, depth, number and type of aquatic habitats, migration patterns, nature of the food chain, level of productivity, water temperature, ability of tributaries to provide recruitment, presence of endangered species, and value to human uses (aesthetic, commercial and sport fishing, and recreational uses).

   As a guideline, zones of influence on larger rivers shall be limited to no more than 25% of the cross-sectional area or volume of flow.

7. When considering discharge impacts, the minimum average daily flow for seven consecutive days that can be expected to occur once in ten years under natural conditions (7Q10) is the minimum flow to which the standard for surface waters apply, except when a stream has been historically regulated to result in low flows below that level, in which case the standards apply to that low flow determined by the Department of Environmental Protection's Minimum Flow Regulations as amended; the Department's Diversion Permit Program; or the Federal Energy Regulatory Commission's hydropower licensing process. Maintaining a long-term flow of 7Q10 or less may result in significant stress on the physical and biological quality of surface waters. Higher flows may be desirable to maintain or achieve designated uses. In those surface waters having regulated flows, at or near the naturally occurring 7Q10 flow, more

stringent water quality criteria may be required to achieve and maintain designated uses. The Commissioner may approve discharge limitations based on minimum average daily flow in excess of 7Q10 conditions, provided the Commissioner is satisfied that special measures will be implemented by the discharger during low flow conditions which provide protection to the environment which would be at least as effective as that protection which would pertain if discharge limitations were based on 7Q10 conditions alone.

8. The Commissioner, pursuant to statutory authority, will regulate discharges to the waters of the State to assure that such discharges do not cause pollution due to acute or chronic toxicity to aquatic and marine life. The strategy to identify and regulate potentially toxic discharges is described in the Department of Environmental Protection's Water Quality Management Plan. The Department's Guidelines for Preparation of Discharge Toxicity Evaluations provides technical guidance to assist dischargers in obtaining the information necessary for assessment of toxic impact.

9. Surface waters and sediments shall be free from chemical constituents which accumulate in tissues of fish, shellfish and other aquatic organisms to levels which will impair the health of aquatic organisms or result in unacceptable tastes, odors or health risks to human consumers of aquatic life.

10. Water quality criteria for benthic invertebrates shall be utilized where appropriate, in evaluation of surface water quality. These criteria describe the fauna of erosional or riffle habitats in flowing waters which are not subject to tidal influences. They are intended to provide guidance for assessment of the biological integrity of surface waters with respect to established water quality goals. These criteria are based on the rationale that biological data, in combination with physical/chemical data, better reflect the attainment of these goals than do physical/chemical data alone.
    The benthic community is widely used for the environmental assessment of flowing waters. The structure of this community is a function of environmental conditions during the life span of the organisms. Consequently, community structure can be altered by the effects of pollution, including intermittent events which could easily be missed by conventional chemical/physical indicators. The well-being of the benthic community is frequently reflected in the well-being of higher forms of aquatic life, such as fish.

11. The discharge of radioactive materials in concentrations or combinations which would be harmful to human, animal or aquatic life shall not be allowed. In no case shall the Alpha emitters in a surface water exceed a concentration of 1,000 picocuries per liter.

12. Reasonable controls or Best Management Practices for control of non-point source pollutants, may be defined by the Commissioner on a case-by-case basis or the Commissioner may require that it be demonstrated by any person or municipality that all reasonable controls will be or are being used.

13. The Commissioner shall establish nutrient effluent limits for wastewater discharges which are determined by DEP to cause cultural (man made) eutrophication that impairs aesthetics, recreation, and/or habitat for fish and aquatic life. No numerical water quality criteria can be established as each watercourse has unique flow characteristics and nutrient inputs from natural and cultural (man made) sources. The intent is to achieve meaningful improvements in the trophic condition of Class B or SB waters through implementation of reasonable point source nutrient controls and control of non-point sources by Best Management Practices.

14. In lakes, ponds and impoundments designated as Class AA or A, water quality management efforts shall be directed towards implementation of reasonable methods of control of non-point sources of nutrients and sediments in order to abate, prevent or minimize eutrophic conditions. Use of these controls is considered preferable to use of biocides for remedial correction of eutrophic conditions.

15. Water quality criteria do not apply to conditions brought about by natural causes. Conditions which exist in the water, in part due to man's normal uses of the land, shall be considered natural. The meaning of the word 'natural' is not limited to only those conditions which would exist in water draining from pristine land. In the case of land lying within a water supply watershed, man's normal use of the land means certain agricultural practices, low density residential development and the improvement and maintenance of secondary roads, provided Best Management Practices are used.

16. There shall be no point source discharge into any natural lake or pond or tributary surface waters which will raise the phosphorus concentration of the receiving surface waters, including phosphorus contained in suspended matter, to an amount in excess of 0.03 mg/l. The Class B impoundments listed below shall be considered natural lakes or ponds.

| Town | Lake or Pond |
|---|---|
| Bozrah | Fitchville Pond |
| Griswold | Ashland Pond |
| Killingly | Fivemile Pond |
| Stafford | Glenville Pond |
| Stafford | Riverside Pond |
| Stafford | Warren Pond |

17. Potential drinking water supplies identified in the Long Range Plan for Management of Water Resources prepared and adopted pursuant to Section 22a-352 of the Connecticut General Statutes shall be designated as Class AA surface waters.

18. Section 22a-417 of the Connecticut General Statutes imposes an absolute restriction on the discharge of sewage to Class AA reservoirs and their tributaries. The coliform bacteria standard of "none of human origin", if violated by a discharge source outside the State where similar requirements are not imposed, shall not be a valid reason for either relaxing the restriction in Connecticut or changing the Class AA designation. It is a State policy to pursue the adoption of compatible Water Quality Standards in neighboring states to assure the protection of Connecticut drinking water supplies.

19. Disinfection shall be required for all treated sewage discharges to surface waters. The period of disinfection shall vary depending on the nature of the receiving waterbody as described below:
    1. Continuous disinfection shall be required at all sewage treatment plants located south of Interstate Highway 95 to protect the sanitary quality of shellfish resources. Continuous disinfection may be required at other locations as determined by the Commissioner.
    2. Disinfection shall be required only during the period from May 1 to October 1 at all sewage treatment plants located north of I-95. Seasonal disinfection is intended to protect the sanitary quality of bathing waters and minimize adverse impacts to aquatic life associated with disinfection. It is recognized that criteria for coliform bacteria may not be met on the above streams during the period when disinfection of sewage treatment plant effluent is not required. The degree of treatment and disinfection shall be as required by the Commissioner and shall be consistent with the health standards established by the Commissioner of Health Services.

20. The discharge of sewage, sink and galley wastes from boats, whether or not treated by any marine sanitation device, is prohibited in all inland freshwaters not capable of interstate navigation. The Department will pursue delegation of authority from EPA for designation of no discharge zones at marinas, near bathing areas and over shellfish areas marked in accordance with Section 19-13-B71 of the Public Health Code.

21. The use of subscript b, as in Class $B_b$, or $SB_b$, is intended to designate the zone of influence in the immediate vicinity of treated sewage outfalls where bathing is not advisable due to elevated concentrations of fecal coliform bacteria.

22. Criteria for fecal coliform organisms are as determined by the membrane filter (MF) method for freshwaters, and the multiple tube fermentation (MPN) method for marine waters. Criteria for coliform bacteria are intended to provide a basis for evaluation of data related to sewage contamination. Due to the inherent uncertainty involved in sampling and analytical determination of coliform levels, excursions from established criteria should be investigated by means of a field survey of sanitary conditions or other appropriate means to determine coliform source and to confirm the sanitary quality of the waterbody in question. (See also Appendix B).

23. The use of subscript c, such as Class $B_c$, $C_c/B_c$, $SB_c$ is to identify areas suitable for cold water fisheries, including spawning, growth and passage. More stringent water quality criteria may apply and will be developed on a case by case basis for these waters.

24. Physical obstructions such as dams, which prevent cold water fish from reaching an area suitable for spawning and growth, shall not be considered a valid reason for not meeting the designated use and quality criteria for fish unless a DEP approved use attainability analysis has been performed.

25. In the estuarine segments (Class SB) of the Housatonic, Connecticut and Thames Rivers the allowable temperature increase from discharges shall be consistent with the criteria for the non-tidal segments (Class B).

26. Except within designated dredged material disposal areas, surface waters shall be substantially free of pollutants that: a) unduly affect the composition of bottom fauna; b) unduly affect the physical or chemical nature of the bottom; or c) interfere with the propagation and habitats of shellfish, finfish, and wildlife. Dredged materials dumped at approved disposal areas shall not pollute the waters of the state and shall not result in; a) floating residues of any sort; b) release of any substance which may result in long-term or permanent degradation of water quality in waters overlying or adjacent to the dumping grounds; c) dispersal of sediments outside a zone of influence enclosing the designated dump points; or d) biological mobilization and subsequent transport of toxic substances to food chains.

27. Sample containers , preservation, handling and analysis should conform to EPA methods promulgated in 40 CFR Part 136, "Guidelines Establishing Test Procedures for the Analysis of Pollutants Under the Clean Water Act," Friday, October 26, 1984 and subsequent amendments. Other different but equivalent methods may be utilized if they have received the Commissioner's prior approval.

28. As part of the Commissioner's continuing efforts to further define water quality standards, other criteria will be considered. The Commissioner reserves the right to amend or extend the criteria for each Class of waters as new information, or improved or more stringent criteria relative to water quality impacts, are developed and justified subject to the legal and procedural requirements of state and federal laws or regulations.

29. Waters which are not otherwise designated shall be considered as Class A or Class SA.

30. Tidal wetlands and tidal creeks shall be considered as Class A or Class SA watercourses unless otherwise designated.

31. Watercourses which are fully enclosed in drainage conduits or pipes and not assigned a specific Class may be considered, on a case-by-case basis, to be the Class of the stream segment to which they discharge.

32. Where existing water quality does not meet the designated use and quality criteria goals, the existing quality will be identified, followed by the use goal (e.g. C/B).

## III. SURFACE WATER CLASSIFICATIONS

### INLAND SURFACE WATERS

### CLASS AA

Designated Use - Existing or proposed drinking water supply; fish and wildlife habitat; recreational use; agricultural, industrial supply and other purposes. (recreational uses may be restricted).

### CRITERIA

| Parameter | Standard |
|---|---|
| 1. Aesthetics | Uniformly excellent |
| 2. Dissolved oxygen | Not less than 5 mg/l at any time. |
| 3. Sludge deposits-solid refuse-floating solids-oils and grease-scum-color | None other than of natural origin. |
| 4. Silt or sand deposits | None other than of natural origin except as may result from normal agricultural, road maintenance, construction activity or dredge material disposal provided all reasonable controls or Best Management Practices are used. |
| 5. Turbidity | Shall not exceed 10 JTU (or NTU equivalent) over ambient levels. A secchi disc shall be visible at a minimum depth of 1 meter. All reasonable controls or Best Management Practices are to be used. |
| 6. Coliform bacteria | Fecal coliform shall not exceed an arithmetic mean of 20 organisms/100 ml in any group of samples nor shall 10% of the samples exceed 100 organisms/100 ml. Refer to Standard number 22 and Appendix B. |
| 7. Taste and odor | None other than of natural origin. |
| 8. pH | As naturally occurs. |

| | | |
|---|---|---|
| 9. | Allowable temperature increase | None other than of natural origin except when it can be demonstrated that cold water fish spawning and growth will not be impaired, in which case Class B standards and criteria apply. |
| 10. | Chemical constituents | None in concentrations or combinations which would be harmful to the most sensitive designated water use. Refer to Standards numbers 6, 7, 8 and 9. |
| | (a) Phosphorus | None other than of natural origin |
| | (b) Sodium | Not to exceed 20 mg/l |
| 11. | Benthic Invertebrates which inhabit lotic waters | A wide variety of macroinvertebrate taxa should normally be present and all functional groups should normally be well represented. Presence and productivity of aquatic species is not limited except by natural conditions, permitted flow regulation or irreversible cultural impacts. Water quality shall be sufficient to sustain a diverse macroinvertebrate community of indigenous species. Taxa within the Orders Plecoptera (stoneflies), Ephemeroptera (may-flies), Coleoptera (beetles) and Trichoptera (caddisflies) should be well represented. |

## CLASSIFICATIONS

| | |
|---|---|
| - AA | Known or presumed to meet water quality criteria which support the designated uses. |
| -B/AA | May not be meeting Class AA water quality criteria or designated uses. The goal is Class AA. |

## INLAND SURFACE WATERS

### CLASS A

Designated Uses - Potential drinking water supply; fish and wildlife habitat; recreational use; agricultural, industrial supply and other legitimate uses, including navigation.

### CRITERIA

| Parameter | Standard |
|---|---|
| 1. Aesthetics | Uniformly excellent |
| 2. Dissolved oxygen | Not less than 5 mg/l at any time. |
| 3. Sludge deposits - solid refuse-floating solids - oils and grease - scum-color. | None other than of natural origin. |
| 4. Silt or sand deposits | None other than of natural origin except as may result from normal agricultural, road maintenance, construction activity or dredge material disposal provided all reasonable controls or Best Management Practices are used. |
| 5. Turbidity | Shall not exceed 10 JTU (or NTU equivalent) over ambient levels. A secchi disc shall be visible at a minimum depth of 1 meter. All reasonable controls or Best Management Practices to be used. |
| 6. Coliform bacteria | Fecal coliform shall not exceed an arithmetic mean of 20 organisms/100 ml in any group of samples nor shall 10% of the samples exceed 100 organisms/100ml. Refer to Standard number 22 and Appendix B. |
| 7. Taste and odor | None other than of natural origin. |
| 8. pH | As naturally occurs. |
| 9. Allowable temperature increase | None other than of natural origin except when it can be demonstrated that cold water fish spawning and growth will not be impaired, in which case Class B standards and criteria apply. |

| | |
|---|---|
| 10. Chemical constituents | None in concentrations or combinations which would be harmful to the most sensitive designated water use. Refer to Standards numbers 6, 7, 8 and 9. |
| (a) Phosphorus | None other than of natural origin. |
| 11. Benthic Invertebrates which inhabit lotic waters | A wide variety of macroinvertebrate taxa should normally be present and all functional groups should normally be well represented. Presence and productivity of aquatic species is not limited except by natural conditions, permitted flow regulation or irreversible cultural impacts. Water quality shall be sufficient to sustain a diverse macroinvertebrate community of indigenous species. Taxa within the Orders Plecoptera (stoneflies), Ephemeroptera (mayflies), Coleoptera (beetles) and Trichoptera (caddisflies) should be well represented. |

## CLASSIFICATIONS

| | |
|---|---|
| - A | Known or presumed to meet water quality criteria which support designated uses. |
| -B/A or C/A | May not be meeting water quality criteria or one or more designated uses. The goal is Class A. |

## INLAND SURFACE WATERS

### CLASS B

Designated Use - Recreational use; fish and wildlife habitat; agricultural and industrial supply and other legitimate uses including navigation.

### CRITERIA

| Parameter | Standard |
|---|---|
| 1. Aesthetics | Good to excellent |
| 2. Dissolved oxygen | Not less than 5 mg/l at any time. |
| 3. Sludge deposits - solid refuse-floating solids - oil and grease - scum - color | None except for small amounts that may result from the discharge from a waste treatment facility providing appropriate treatment. |
| 4. Silt or sand deposits | None other than of natural origin except as may result from normal agricultural, road maintenance, construction activity or dredge material disposal provided all reasonable controls or Best Management Practices are used. |
| 5. Turbidity | Shall not exceed 25 JTU (or NTU equivalent); Class $B_c$ not to exceed 10 JTU (or NTU equivalent) over ambient levels. A secchi disc shall be visible at a minimum depth of 1 meter. Criteria may be exceeded in Class $B_b$ waters. All reasonable controls and Best Management Practices to be used. |
| 6. Coliform bacteria | Fecal coliform shall not exceed a log mean of 200 organisms/100 ml in any group of samples nor shall 10% of the samples exceed 400 organisms/100 ml. Refer to Standard number 22 and Appendix B. |
| 7. Taste and odor | None that would impair any usages specifically assigned to this Class. |
| 8. pH | 6.5 - 8.0 |

| | | |
|---|---|---|
| 9. | Allowable temperature increase | None except where the increase will not exceed the recommended limit on the most sensitive receiving water use and in no case exceed 85°F, or in any case raise the normal temperature of the receiving water more than 4°F. |
| 10. | Chemical constituents | None in concentrations or combinations which would be harmful to the most sensitive designated water use. Refer to Standards numbers 6, 7, 8 and 9. Reasonable controls on point and non-point sources of phosphorous which are considered significant contributors to eutrophication of lakes, ponds and impoundments may be required. Refer to Standard number 13. |
| 11. | Benthic Invertebrates which inhabit lotic waters | Water quality shall be sufficient to sustain a diverse macroinvertebrate community of indigenous species. All functional groups and a wide variety of macroinvertebrate taxa shall be present, however one or more may be disproportionate in abundance. Waters which currently support a high quality aquatic community shall be maintained at that high quality. Presence and productivity of taxa within the Orders Plecoptera (stone-(flies), Ephemeroptera (mayflies); and pollution intolerant Coleoptera (beetles) and Trichoptera (caddisflies) may be limited due to cultural activities. Macroinvertebrate communities in waters impaired by cultural activities shall be restored to the extent practical through implementation of the department's procedures for control of toxic pollutant discharges to surface waters and through Best Management Practices for non-point sources of pollution. |

## CLASSIFICATIONS

| | |
|---|---|
| - B | Known or presumed to meet water quality criteria which support designated uses. |
| - C/B or D/B | Presently does not meet the water quality criteria or one or more designated uses. The goal is Class B. |

## INLAND SURFACE WATERS

### CLASS C

Existing Use - Certain fish and wildlife habitat, certain recreational activities, agricultural, industrial and other legitimate uses, including navigation; swimming may be precluded; one or more Class B criteria or designated uses may be impaired; goal is Class B unless a DEP and EPA approved use attainability analysis determines certain uses are non-attainable. Refer to Standard number 3.

### CRITERIA

| Parameter | Quality |
|---|---|
| 1. Aesthetic | May be poor to excellent. |
| 2. Dissolved oxygen | May be less than 5 mg/l under some conditions. |
| 3. Sludge deposits-solid refuse-floating solids-oils and grease-scum-color | None except for small amounts that may result from the discharge from a waste treatment facility providing appropriate treatment. |
| 4. Silt or sand deposits | None other than of natural origin except as may result from normal agricultural, road maintenance, construction activity, or dredge material disposal provided all reasonable controls or Best Management Practices are used. |
| 5. Turbidity | May exceed 25 JTU (or NTU equivalent). All reasonable controls or Best Management Practices to be used. |
| 6. Coliform bacteria | May exceed Class B criteria. |
| 7. Taste and odor | None that would impair any usages specifically assigned to Class B waters. |
| 8. pH | 6.0 - 8.5 |

| | | |
|---|---|---|
| 9. | Allowable temperature increase | None except where the increase will not exceed the recommended limit on the most sensitive receiving water use and in no case exceed 85°F or in any case raise the normal temperature of the receiving water more than 4°F. |
| 10. | Chemical constituents | May occasionally be present in concentrations or combinations which limit the distribution or abundance of aquatic life. Refer to Standards numbers 6, 7, 8 and 9. |
| 11. | Benthic Invertebrates which inhabit lotic waters | Some functional groups may be absent or disproportionate in abundance. Class C criteria are presented for descriptive purpose only to identify impaired stream segments. The macroinvertebrate community may reflect a significant degree of water quality impairment. Pollution sensitive taxa within the Orders Plecoptera(stoneflies), Ephemeroptera (mayflies), Coleoptera (beetles) and Trichoptera(caddisflies) are absent. If a permanent macroinvertebrate community exists, facultative or pollution tolerant taxa may be represented by pollution tolerant Trichoptera (caddisflies), Odonata (dragonflies), Diptera (trueflies), Isopoda (sow bugs), Amphipoda (scud), Hirudinia (leeches), Tubificia (tubificid worms) and/or Mollusca (snails, clams). |

## CLASSIFICATIONS

| | |
|---|---|
| - C/B, C/A or C/AA | Presently not meeting water quality criteria or one or more designated uses due to pollution. The goal for such waters may be Class AA, A or Class B depending upon the specific uses designated for a water course. In those cases where an approved use attainability analysis has been conducted, certain designated uses may not be sought. |

## INLAND SURFACE WATERS

### CLASS D

Present conditions severely inhibit or preclude one or more designated uses for extended time periods or totally preclude attainment of one or more designated uses. May be suitable for bathing or other recreational purposes, certain fish and wildlife habitat, industrial and other legitimate uses, including navigation, may have good aesthetic value.

Examples of conditions which warrant Class D designation include, severe sediment contamination which limits utilization of a water by aquatic organisms; presence of chemical contaminants in fish and/or shellfish which represent an unacceptable health risk to human consumers; consistently high concentrations of indicator bacteria or eutrophication effects (nuisance conditions) which preclude use of a water body for swimming during the summer months, or frequent occurrence of anoxic conditions (dissolved oxygen less than 1 ppm).

The goal is Class B unless a DEP and EPA approved use attainability analysis determines certain uses are non-attainable. Refer to Standard number 3.

### CLASSIFICATIONS

| | |
|---|---|
| D/B, D/A - | Presently not meeting water quality criteria or one or more designated uses due to severe pollution. The goal for such waters may be Class A or Class B depending upon the specific uses designated for a watercourse. In those cases where an approved use attainability analysis has been conducted, certain designated uses may not be sought. |

# LAKE TROPHIC CLASSIFICATIONS

## OLIGOTROPHIC

May be Class AA, Class A, or Class B water; Low in plant nutrients; Low biological productivity characterized by the absence of nuisance macrophyte beds. Excellent opportunities for water contact recreation.

### CRITERIA

| Parameters | Standard |
|---|---|
| 1. Total Phosphorus | 0-10 ug/l spring and summer |
| 2. Total Nitrogen | 0-200 ug/l spring and summer |
| 3. Chlorophyll-a | 0-2 ug/l mid-summer |
| 4. Secchi Disk Transparency | 6 + meters mid-summer |

## MESOTROPHIC

May be Class AA, Class A, or Class B water. Moderately enriched with plant nutrients. Moderate biological productivity characterized by occasional nuisance blooms of algae and/or small areas of nuisance macrophyte beds. Good opportunities for water contact recreation.

### CRITERIA

| Parameters | Standard |
|---|---|
| 1. Total Phosphorus | 10-30 ug/l spring and summer |
| 2. Total Nitrogen | 200-600 ug/l spring and summer |
| 3. Chlorophyll-a | 2-15 ug/l mid-summer |
| 4. Secchi Disk Transparency | 2-6 meters mid-summer |

## EUTROPHIC

May be Class AA, Class A, or Class B water. Highly enriched with plant nutrients. High biological productivity characterized by frequent nuisance blooms of algae and/or extensive areas of dense macrophyte beds. Water contact recreation opportunities may be limited.

### CRITERIA

| Parameters | Standard |
|---|---|
| 1. Total Phosphorus | 30-50 ug/l spring and summer |
| 2. Total Nitrogen | 600-1000 ug/l spring and summer |
| 3. Chlorophyll-a | 15-30- ug/l mid-summer |
| 4. Secchi Disk Transparency | 1-2 meters mid-summer |

## HIGHLY EUTROPHIC

May be Class AA, Class A, or Class B water. Excessive enrichment with plant nutrients. High biological productivity, characterized by severe nuisance blooms of algae and/or extensive areas of dense macrophyte beds. Water contact recreation may be extremely limited.

### CRITERIA

| Parameters | Standard |
|---|---|
| 1. Total Phosphorus | 50 + ug/l spring and summer |
| 2. Total Nitrogen | 1000 + ug/l spring and summer |
| 3. Chlorophyll-a | 30 + ug/l mid-summer |
| 4. Secchi Disk Transparency | 0-1 meters mid-summer |

## OLIGOTROPHIC

| Lake | Town |
|---|---|
| Alexander | Killingly |
| Beach | Voluntown |
| Highland | Winchester |
| Mashapaug | Union |
| West Hill | New Hartford |

## MESOTROPHIC

| | |
|---|---|
| Black | Meriden/Middlefield |
| Bolton (Middle) | Vernon |
| Bolton (Lower) | Bolton/Vernon |
| Candlewood | New Fairfield/Sherman/New Milford Danbury/Brookfield |
| Cedar | Chester |
| Cream Hill | Cornwall |
| Crystal | Ellington/Stafford |
| Dodge | East Lyme |
| East Twin | Salisbury |
| Gardner | Salem/Montville/Bozrah |
| Gorton | East Lyme |
| Hayward | East Haddam |
| Hitchcock | Wolcott |
| Long | Ledyard/North Stonington |
| Mamanasco | Ridgefield |
| Mt. Tom | Litchfield/Morris/Washington |
| Mudge | Sharon |
| Pachaug | Griswold |
| Pataganset | East Lyme |
| Pocotopaug | East Hampton |
| Quassapaug | Middlebury |
| Rogers | Lyme/Old Lyme |
| Shenipsit | Vernon/Ellington/Tolland |
| Taunton | Newtown |
| Terramuggus | Marlborough |
| Tyler | Goshen |
| West Side | Goshen |
| Wyassup | North Stonington |

## EUTROPHIC

| Lake | Town |
|---|---|
| Bantam | Litchfield/Morris |
| Batterson Park | Farmington/New Britain |
| Beseck | Middlefield |
| Roseland | Woodstock |
| Waramaug | Warren/Kent/Washington |
| Wononscopomuc | Salisbury |

## HIGHLY EUTROPHIC

| | |
|---|---|
| Cedar | North Branford |
| Lillinonah | Southbury/Bridgewater/Brookfield/ Newtown |
| Linsley | North Branford |
| North Farms | Wallingford |
| Silver | Berlin/Meriden |
| Zoar | Newtown/Monroe/Oxford/Southbury |
| 1860 Reservoir | Wethersfield |

## COASTAL AND MARINE SURFACE WATERS

## CLASS SA

Designated Use - Marine fish, shellfish and wildlife habitat, shellfish harvesting for direct human consumption, recreation, and all other legitimate uses including navigation.

### CRITERIA

| Parameters | Standard |
|---|---|
| 1. Aesthetics | Uniformly excellent |
| 2. Dissolved oxygen | Not less than 6.0 mg/l at any time. |
| 3. Sludge deposits-solid refuse-floating solids-oils and grease-scum-color | None other than of natural origin |
| 4. Silt or sand deposits | None other than of natural origin except as may result from normal agricultural, road maintenance, construction activity, or dredge material disposal provided all reasonable controls and Best Management Practices are used. |
| 5. Turbidity | None other than of natural origin except as may result from normal agricultural, road maintenance, construction activity, or dredge material disposal provided all reasonable controls and Best Management Practices are used. A secchi disc shall be visible at a minimum depth of 1 meter. |
| 6. Coliform bacteria | Total coliform shall not exceed a median of 70 colonies/100 ml nor shall 10% of the samples exceed 230 organisms/100ml. Shellfish harvesting for direct human consumption is the most restrictive use of this Class with respect to sanitary quality of water, consequently this standard is adopted to maintain consistence with section 19-13-B65(c) of the Connecticut Public Health Code. Refer to standard number 22 and Appendix B. |

| | | |
|---|---|---|
| 7. | Taste and odor | As naturally occurs. |
| 8. | pH | 6.8 - 8.5 |
| 9. | Allowable temperature increase | None except where the increase will not exceed the recommended limit on the most sensitive receiving water use and in no case exceed 83°F or in any case raise the normal temperature of the receiving water more than 4°F. During the period including July, August and September, the normal temperature of the receiving water shall not be raised more than 1.5°F unless it can be shown that spawning and growth of indigenous organisms will not be significantly affected. |
| 10. | Chemical constituents | None in concentrations or combinations which would be harmful to the most sensitive designated water use. Refer to Standards numbers 6, 7, 8 and 9. |

## CLASSIFICATIONS

| | |
|---|---|
| - SA | Know or presumed to meet water quality criteria which support designated uses. |
| - SB/SA or SC/SA | Presently not meeting water quality criteria or one or more designated uses. The goal is Class SA. |

## COASTAL AND MARINE SURFACE WATERS

### CLASS SB

Designated Uses - Marine fish, shellfish and wildlife habitat, recreation, industrial and other legitimate uses including navigation.

### CRITERIA

| Parameter | Standard |
|---|---|
| 1. Aesthetic | Good to excellent |
| 2. Dissolved oxygen | Not less than 5.0 mg/l at any time. |
| 3. Sludge deposits-solid refuse-floating solids-oils and grease-scum-color | None except for small amounts that may result from the discharge from a waste treatment facility providing appropriate treatment. |
| 4. Sand or silt deposits | None other than of natural origin except as may result from normal agricultural, road maintenance, construction activity, or dredge material disposal provided all reasonable controls and Best Management Practices are used. |
| 5. Turbidity | A secchi disc shall be visible at a minimum depth of 1 meter. Criteria may be exceeded in Class SB$_b$ waters. All reasonable controls and Best Management Practices to be used. |
| 6. Coliform bacteria | Fecal coliform shall not exceed a log mean of 200 organisms/100ml nor shall 10% of the samples exceed 400 organisms/100 ml. Refer to Standard number 22 and Appendix B. |
| 7. Taste and odor | As naturally occurs. None that would impair any usages specifically assigned to this Class. |
| 8. pH | 6.8 - 8.5 |

| | |
|---|---|
| 9. Allowable temperature increase | None except where the increase will not exceed the recommended limit on the most sensitive receiving water use and in no case exceed 83°F or in any case raise the normal temperature of the receiving water more than 4°F. During the period including July, August and September, the normal temperature of the receiving water shall not be raised more than 1.5°F unless it can be shown that spawning and growth of indigenous organisms will not be significantly affected. |
| 10. Chemical constituents | None in concentrations or combinations which would be harmful to the most sensitive designated water use. Refer to Standards numbers 6, 7, 8, and 9. |

## CLASSIFICATIONS

| | |
|---|---|
| - SB | Known or presumed to meet water quality criteria which support designated uses. |
| - SC/SB or SD/SB | Presently not meeting water quality criteria or one or more designated uses. The goal is Class SB. |

## COASTAL AND MARINE SURFACE WATERS

### CLASS SC

Existing Uses - Certain marine fish, shellfish and wildlife habitat; recreational boating, industrial and other legitimate uses, including navigation and swimming; one or more Class SB criteria or designated uses impaired; goal is Class SB unless a DEP and EPA approved use attainability analysis determines certain uses are non-attainable. Refer to Standard number 3.

### CRITERIA

| Parameter | Quality |
|---|---|
| 1. Aesthetics | Good |
| 2. Dissolved oxygen | May be less than 5 mg/l at any time. |
| 3. Sludge deposits-solid refuse-floating solids - oils and grease-scum-color | None except for small amounts that may result from the discharge from a waste treatment facility providing appropriate treatment. |
| 4. Sand and silt deposits | None other than of natural origin except as may result from normal agricultural, road maintenance, construction activity, or dredge material disposal provided all reasonable controls and Best Management Practices are used. |
| 5. Turbidity | None that would impair any usages specifically assigned to Class SB. |
| 6. Coliform bacteria | May exceed Class SB standard. |
| 7. Taste and odor | As naturally occurs. None that would impair any usages specifically assigned to Class SB waters. |
| 8. pH | 6.5 - 8.5 |

| | | |
|---|---|---|
| 9. | Allowable temperature increase | None except where the increase will not exceed the recommended limit on the most sensitive receiving water use and in no case exceed 83°F or in any case raise the normal temperature of the receiving water more than 4°F. During the period including July, August and September, the normal temperature of the receiving water shall not be raised more than 1.5°F unless it can be shown that spawning and growth of indigenous organisms will not be significantly affected. |
| 10. | Chemical constituents | May occasionally be present in concentrations or combinations which limit the distribution or abundance of aquatic life. Refer to Standards numbers 6, 7, 8, and 9. |

## CLASSIFICATIONS

| | |
|---|---|
| - SC/SB or SC/SA | Presently not meeting water quality criteria or one or more designated uses due to pollution. The goal for such waters may be Class SA or Class SB depending upon the specific uses designated for a watercourse. In those cases where an approved use attainability analysis has been conducted, certain designated uses may not be sought. |

## COASTAL WATERS

### CLASS SD

Present conditions severely inhibit one or more designated uses for extended time periods or totally preclude attainment of one or more designated uses. May be suitable for bathing or other recreational purposes; certain fish, shellfish and wildlife habitat; industrial and other legitimate uses, including navigation; may have good aesthetic value.

Examples of conditions which warrant Class SD designations include, severe sediment contamination which limits utilization of a water body by aquatic organisms; presence of chemical contaminants in fish and/or shellfish which represent an unacceptable health risk to human consumers; consistently high concentrations of indicator bacteria or eutrophication effects (nuisance conditions) which preclude use of a water body for swimming during the summer months, or frequent occurrence of anoxic conditions (dissolved oxygen less than 1 ppm).

The goal is Class SB unless a DEP and EPA approved use attainability analysis determines certain uses are non-attainable. Refer to standard number 3.

### CLASSIFICATIONS

| | |
|---|---|
| - SD/SB, SD/SA | Presently not meeting water quality criteria or one or more designated uses due to severe pollution. The goal for such waters may be Class SA of Class SB depending upon the specific uses designated for a water course. In those cases where an approved use attainability analysis has been conducted, certain designated uses may not be sought. |

## IV. GROUND WATERS STANDARDS

33. The goal of the Commissioner is, wherever feasible, to restore or maintain all ground waters to a quality consistent with its use for drinking without treatment. In keeping with this goal, all degraded ground waters shall be restored to the extent possible to a quality consistent with Class GAA or GA. However, attainment of Class GAA or GA quality may not be sought when:
    - A) The ground water is in a zone of influence of a permitted discharge in a Class GAA or GA area.;
    - B) The ground water goal is designated as Class GB; unless there is a demonstrated need to restore ground waters to Class GA or where it can be demonstrated to the Commissioner that restoration to Class GA cannot be reasonably achieved;
    - C) The ground water goal is designated as Class GC.

34. Ground waters with existing quality better than established standards for that Class will be maintained at their existing high quality. Any applicant for a new discharge to such waters may be required to demonstrate to the Commissioner that the discharge is justifiable due to overriding economic or social needs. The Commissioner may require a level of treatment which will result in water quality .exceeding Federal and State Potable Water Supply Criteria. Other special treatment requirements deemed necessary to prevent pollution and which will maintain existing uses made of, or presently possible for such waters, may also be required.

35. Ground waters shall not be lowered in Class designation unless and until it has been affirmatively demonstrated to the Commissioner such change is justifiable due to overriding economic or social needs and will not interfere with or become injurious to any existing use made of or presently possible in such waters or that of adjacent surface waters. Any applicant requesting a change in a water quality classification will be required to demonstrate to the Commissioner the proposed new Class designation is consistent with all such uses.

36. Discharges to ground water shall be limited in conformance with the following:
    - (A) Class GAA Ground Waters: permits may be granted for discharges of domestic sewage as defined in Section 22a-430-1 of the regulations of state agencies or wastes from acceptable agricultural practices or backwash from public drinking water treatment systems or other minor cooling or clean water discharges.
    - (B) Class GA Ground Waters: permits may be granted for those discharges permitted in Class GAA areas and septage disposal or disposal of other wastes of predominantly human or animal origin. These ground waters may receive effluents containing substances of natural origin or materials which easily biodegrade in the soil system and pose no threat to untreated drinking water supplies drawn from the ground water outside any zone of influence.
    - (C) Class GB Ground Waters: permits may be granted for discharges permitted in Class GAA and Class GA ground waters. In addition, permits may be granted for treated industrial process waters

amenable to further treatment by soils and for the siting of land disposal facilities specifically designed such that resultant discharges shall not cause ground water degradation that could preclude its future use as a drinking water source or prevent maintenance or attainment of adjacent surface water designated uses.

(D) Class GC Ground Waters: There is a present and continuing need to allow discharges to the ground which are currently best treated by making use of the restoration or attenuation characteristics of the soil and subsurface hydrogeologic conditions. The best places to meet this need in Connecticut exist in limited areas of the State where specific geologic, ground and surface water conditions exist that may be most favorable to the acceptance of such discharges. In many Class GC areas, the historic waste disposal practices may have, for all practical purposes, permanently rendered the ground water unsuitable for drinking water without treatment, and/or the development of large yield and high quality water supply from the aquifer conditions is unlikely. Permits may be granted for all discharges allowed in areas designated as Class GAA, Class GA, and Class GB. Class GC areas may also be suitable for other discharges with the following requirements:

(1) The discharge must operate under a 22a-430 discharge permit.

(2) The discharge must not prevent attainment or maintenance of any adjacent surface water designated use.

(3) The ground water within the extent of the zone of influence resulting from the discharge must be owned or controlled by the discharger and must be adequately monitored.

(4) There must be no conflict between the discharge and the need for public or private water supply.

37. Zones of influence created by a permitted discharge shall not affect existing or potential designated uses. The Commissioner may require of applicants that information which will enable him to establish zones of influence in permitting discharges to ground water.

(1) Zones of influence may be allowed and the determination of boundaries of a zone shall be required when natural soil materials are used to treat a discharge or to allow the dilution of substances by ground water to acceptable concentrations for discharge to the surface waters in an effluent/ground water mix which will not prevent attainment or maintenance of adjacent surface water designated uses.

(2) The zone of influence for subsurface sewage disposal systems which are permitted under the authority delegated to the Commissioner of Health Services by Section 22a-430, shall be defined as the area required by the separating distances established as minimum requirements in the Public Health Code.

(3) The zone of influence for all other discharges to the ground water shall be the area in which the ground water could be in violation of any pertinent federal and state drinking water standards or otherwise be polluted by the discharge.

(4) Property rights to ground water and permission to degrade ground water are not automatically granted by assignment of a Class. The Commissioner may require applicants for Section 22a-430 permits a demonstration they have acquired rights to any ground water which may be degraded by their discharge. The Commissioner may also require such applicants to record the effect and extent of any discharge, and duration of same following its cessation, on relevant land records.

38. Ground waters assigned to a specific Class are not protected by such designation when the subsequent withdrawal of ground waters induces infiltration from an adjacent surface water or induces flow from an authorized zone of influence or flow from an adjacent ground water area of a different classification. For new ground water withdrawals, the impacts attributable to induced flow of lower Class ground waters would be a consideration in issuance of permits through the state's Water Diversion Program (Section 22a-365 through 378 of the CGS).

39. Ground waters shall be free of chemical constituents in concentrations or combinations which would be harmful to the assigned Class.

40. The discharge of radioactive materials in concentrations or combinations which would be harmful to human, animal or aquatic life shall not be allowed. In no case shall the Alpha emitters in surface waters to which ground waters flow exceed a concentration of 1,000 picocuries per liter.

41. Reasonable controls or Best Management Practices may be defined by the Commissioner on a case-by-case basis or the Commissioner may require that it be demonstrated by any person or municipality that all reasonable controls will be or are being used.

42. Potential drinking water supplies identified in the Long Range Plan for Management of Water Resources prepared and adopted pursuant to Section 22a-352 of the Connecticut General Statutes shall be designated as Class GAA ground waters.

43. Sample containers, preservation, handling and analysis should conform to EPA methods promulgated in 40 CFR Part 136, "Guidelines Establishing Test Procedures for the Analysis of Pollutants Under the Clean Water Act," as amended. Other different but equivalent methods may be utilized if they have received the Commissioner's prior approval.

44. As part of the Commissioner's continuing efforts to further define water quality standards, other criteria will be considered. The Commissioner reserves the right to amend or extend the criteria for each Class of waters as new information, or improved or more stringent criteria relative to water quality impacts, are developed and justified subject to the legal and procedural requirements of state and federal laws or regulations.

45. Where existing water quality does not meet the designated use and quality criteria goal, the existing quality will be identified, followed by the use goal (e.g. GB/GA).

46. Ground waters which are not otherwise designated shall be considered as Class GA.

## V. GROUND WATER CLASSIFICATIONS

### GROUND WATERS

### CLASS GAA

Designated Use - Existing or potential public drinking water supply.

### CRITERIA

| Parameter | Standard |
|---|---|
| 1. Dissolved oxygen | As naturally occurs. |
| 2. Oils and grease | None other than of natural origin. |
| 3. Color and turbidity | None other than of natural origin. |
| 4. Coliform bacteria | Not to exceed a monthly arithmetic mean of 1 or, more than 4 in any individual sample collected. |
| 5. Taste and odor | None other than of natural origin. |
| 6. pH | As naturally occurs or as may result from normal agricultural, horticultural, lawn maintenance or construction activity provided all reasonable controls are used. |
| 7. Chemical constituents | Subject to standards of Section 19-13-B102 of the Connecticut Public Health Code, advisories of the Department of Health Services and primary and secondary standards of the Federal Safe Drinking Water Act. |

### CLASSIFICATIONS

| | |
|---|---|
| - GAA | Ground waters tributary to public water supply watersheds or within the area of influence of community and non-community water supply wells. Presumed suitable for direct human consumption without need for treatment. The State's goal is to maintain drinking water quality. |

| | |
|---|---|
| - GB/GAA | Ground waters tributary to public water supply watersheds or within the area of influence of community and non-community water supply wells. May not be suitable for direct human consumption without treatment due to contamination from waste discharges, spills or leaks of chemicals or land use impacts. The State's goal is to restore the ground water to drinking water quality. |

## GROUND WATERS

### CLASS GA

Designated Use: Existing private and potential public water supply.

### CRITERIA

| Parameter | Standard |
|---|---|
| 1. Dissolved oxygen | As naturally occurs. |
| 2. Oils and grease | None other than of natural origin. |
| 3. Color and turbidity | None other than of natural origin. |
| 4. Coliform bacteria | Not to exceed a monthly arithmetic mean of 1 or more than 4 in any individual sample collected. |
| 5. Taste and odor | None other than of natural origin. |
| 6. pH | As naturally occurs or as may result from normal agricultural, horticultural, lawn maintenance or construction activity provided all reasonable controls are used. |
| 7. Chemical constituents | Subject to standards of Section 19-13-B102 of the Connecticut Public Health Code, advisories of the Department of Health Services and primary and secondary standards of the Federal Safe Drinking Water Act. |

### CLASSIFICATIONS

| | |
|---|---|
| - GA | Ground waters within the area of influence of private and potential public wells. Presumed suitable for direct human consumption without need for treatment. The state's goal is to maintain the drinking water quality. |

| | |
|---|---|
| - GB/GA | Ground waters which may not be suitable for direct human consumption without treatment due to waste discharges, spills or leaks of chemicals or land use impacts. The State's goal is to restore the ground water to drinking water quality. |

## GROUND WATERS

## CLASS GB

Designated Use: Industrial process water and cooling waters; presumed not suitable for direct human consumption without treatment.

### CRITERIA

| Parameter | Standard |
|---|---|

No qualitative criteria can be specified as ground waters of this Class are known or may reasonably be presumed to be degraded due to a variety of pollution sources.

### CLASSIFICATIONS

| | |
|---|---|
| - GB | Ground waters within highly urbanized areas or areas of intense industrial activity and where public water supply service is available. May not be suitable for direct human consumption due to waste discharges, spills or leaks of chemicals or land use impacts. The State's goal is to prevent further degradation by preventing any additional discharges which would cause irreversible contamination. |

## GROUND WATERS

## CLASS GC

**Designated Use:** Assimilation of discharges permitted by the Commissioner pursuant to Section 22a-430 of the Connecticut General Statutes. Refer to Standard number 35.

### CRITERIA

| Parameter | Standard |
|---|---|

No qualitative criteria are specifically determined until such time permit applications are prepared. The most sensitive governing considerations for use of ground waters in this Class is the impact of any permitted wastewater flows on adjacent surface waters.

### CLASSIFICATIONS

| | |
|---|---|
| - GA/GA/GC | areas not presently used for waste disposal and where existing water quality is presumed to be suitable for direct human consumption. The Department's immediate goal is to maintain existing water quality. The potential use of the groundwaters for purposes other than drinking water, based on a preliminary evaluation of hydrogeologic conditions, is indicated by the Class GC designation. A municipality or person may submit permit applications for certain wastewater discharges and a request to change to Class GC. Issuance of the discharge permit and the concurrent change to a GC classification may be made upon the Commissioner's findings that the discharge will not cause pollution of the waters of the state. Applications must include an assessment of discharge impacts on surface waters, acceptable hydrogeologic studies and compliance with other applicable requirements set forth in the Standards. |

| | |
|---|---|
| - GB/GB/GC | Areas which have been used for waste disposal or where contaminants have been introduced into the ground water. Water quality is known or presumed unsuitable for direct human consumption. The Department's immediate goal is prevent irreversible contamination of the ground waters. The potential use of these ground waters for purposes other than drinking water is indicated by the Class GC designation. A municipality or person may submit permit applications for certain wastewater discharges and a request to change to Class GC. Issuance of the discharge permit and the concurrent change to a GC classification may be made upon the Commissioner's findings that the discharge will not cause pollution of the waters of the state. Applications must include an assessment of discharge impacts on surface waters, acceptable hydrogeologic studies and compliance with other applicable requirements set forth in the Standards. |
| - GC: | Areas where the Commissioner has issued a permit for a ground water discharge consistent with these criteria and Section 22a-430 of the Connecticut General Statutes. Use of the soil and ground waters for treatment and assimilation of certain wastewaters has been sanctioned by the department through permit. The owner and operator of the waste treatment and disposal facility has performed all necessary hydrogeologic studies, secured rights to all affected ground waters, and has complied with all other requirements of Connecticut's Water Quality Standards. Ground waters not suitable for development of drinking water supplies. |

## APPENDIX A

### DEFINITIONS

ACUTE TOXICITY - Adverse effect such as mortality or debilitation caused by a brief exposure to a relatively high concentration of a toxic substance.

AMBIENT - Normally occurring conditions in a waterbody.

ANTIDEGRADATION - A statement of practice required by federal law which prohibits a state from lowering surface water quality classifications or standards in order to accommodate new or increased wastewater discharges or land use practices which impact a particular water course. The state must attain, and maintain the most sensitive existing and potential use for a respective waterbody.

BENTHIC - Refers to organisms or material associated with the bottom of watercourses.

BENTHIC MACROINVERTEBRATES - Animals large enough to be seen by the unaided eye and can be retained by a U. S. standard No. 30 sieve (28 meshes per inch, 0.595 mm openings). They must live at least part of their life cycle within or upon submerged substrates in a body of water. These animals usually consist of the aquatic life stages of various insects and arthropods, molluscs, leeches and worms.

BEST MANAGEMENT PRACTICES - Those practices which reduce waste discharges into waters of the state and which have been determined by the Commissioner to be acceptable based on, but not limited to, technical, economic and institutional feasibility.

CHRONIC TOXICITY - Adverse effect, such as reduced reproductive success or growth, poor survival of sensitive life stages which occurs as a result of exposure to relatively low concentrations of a toxic substance.

CLASSIFICATIONS - Designation of the proposed uses of surface and ground waters with alphabetic character. Where classifications appear in two sections separated by a diagonal line, the first classification indicates existing use or general quality and the second classification indicates the water use goal.

CLEAN WATER - Water, which in the judgement of the Commissioner, is of a quality substantially similar to that occurring naturally in the receiving stream under consideration; e.g. minor cooling waters, dredging and dredged material dewatering waters.

COMMISSIONER - Commissioner of Environmental Protection.

COASTAL AND MARINE WATERS - Those waters generally subject to the rise and fall of the tide and as defined by Section 22a-93 of the Connecticut General Statutes as amended.

CRITERIA - Elements of Connecticut's Water Quality Standards, expressed in parameters and their constituent concentrations, levels, or by narrative statements, representing a quality of water that supports a particular designated use.

DEPARTMENT - The Connecticut Department of Environmental Protection.

DEPURATION - Controlled shellfish purification process where a controlled environment is used to reduce the level of bacteria and viruses in shellfish. The process usually includes a fixed structure having a specified water circulation and disinfection system, together with designed tanks and racks.

DESIGNATED USE - Those uses specified in Connecticut's Water Quality Standards for each surface watercourse or ground water area, whether or not they are being attained.

DISCHARGE - Defined in Sec. 22a-423 as ".... the emission of any water, substance or material into the waters of the state, whether or not such substance causes pollution."

DISCHARGE TOXICITY EVALUATION - A structured scientific analysis of the toxic strength and discharge rate of a treated wastewater effluent relative to available dilution in the receiving water. Prepared as described in the Department's guidance document, Guidelines for Preparation of Discharge Toxicity Evaluations. An analysis typically contains data and supporting information on receiving waterbody characteristics and recommendations regarding possible approaches to reduce effluent toxicity and in-stream toxic impacts resulting from the discharge.

DREDGING - The excavation, removal or dispersal of sediments.

EFFLUENT - Treated waste process waters or cooling waters discharged from a waste treatment or manufacturing facility.

EUTROPHICATION - The process of enrichment of surface waters with plant nutrients which may cause nuisance algae blooms and excessive growth of aquatic weeds.

FUNCTIONAL GROUP - General category of benthic macroinvertebrates based on feeding mechanisms.

GROUND WATERS - Waters flowing through earth materials, beneath the ground surface.

| | |
|---|---|
| HIGH QUALITY WATERS | Waters of a quality which exceed established standards for the respective Class. May sustain a sensitive use which is designated for a higher Class. Refer to Standard number 2. |
| INDIGENOUS | Animal or plant life which are naturally occurring inhabitants of a certain geographic region. |
| INVERTEBRATES | Animals lacking a backbone. |
| LENTIC | Standing water environments, such as lakes and ponds. |
| LOTIC | Refers to flowing water habitats, as in streams or rivers. |
| MOST SENSITIVE USE | The water use (drinking, swimming, boating, fish and aquatic life propagation, irrigation etc.) which is most susceptible to degradation by a specific pollutant.<br>(e.g. Bacterial contamination can preclude swimming but not fish production; copper concentrations as low as 20 parts per billion (ppb) may adversely affect sensitive species of fish and aquatic life while drinking water quality is not affected until copper concentrations approach the secondary drinking water Maximum Concentration Level (MCL) of 1,000 parts per billion). |
| MSD | Marine Sanitation Device. Devices installed or used on watercraft for the collection, treatment and disposal of human wastes. |
| NON-POINT SOURCE | Wastewaters, leachate or runoff which originate from diffuse sources or widespread areas. For example; soil erosion from construction sites. |
| POINT SOURCES | Treated or untreated wastewater discharges from manufacturing or sewage treatment works which are conveyed to their discharge point within discrete, readily identifiable pipes or conduits or are emitted through some other similar single point. For example, an outfall pipe from a sewage treatment plant. |
| SEDIMENTS | Any natural or artificial materials which constitute all or part of the banks, bed or bottom of an intermittent or perennial watercourse. |
| SEWAGE | Defined in Sec. 22a-423 as, "human and animal excretions and all domestic and such manufacturing wastes as may tend to be detrimental to the public health". |
| SURFACE WATERS | Waters which flow over the earth's surface, whether or not confined in natural watercourses. |

| | | |
|---|---|---|
| TAXON (pl. Taxa) | - | Refers to a biological classification category, usually the finest division attainable in current taxonomy. Most benthic organisms are identified to genus or species. |
| TECHNOLOGY BASED TREATMENT | - | Waste treatment defined under the provisions of Sections 301(b) and 304(b) of the Federal Water Pollution Control (Clean Water) Act. The level and type of treatment required is based on the manufacturing process used and type of waste generated. |
| TIDAL WETLANDS AND CREEKS | - | Defined in Section 22a-29 of the Connecticut General Statutes as those areas which border on or lie beneath tidal waters. |
| TOXIC SUBSTANCE | - | Any substance which can adversely affect the survival, growth or reproduction of fish, other forms of aquatic life or humans exposed to the substance either by direct contact or through consumption of aquatic organisms. |
| TRANSPLANTATION | - | Harvesting shellfish from designated closed areas, transporting and placing the shellfish onto other designated areas for propagation, growth, purification or transfer to an approved depuration plant. |
| TROPHIC CONDITIONS | - | The state of enrichment of a waterbody with plant nutrients. |
| USE ATTAINABILITY ANALYSIS | - | A structured scientific assessment of the factors affecting the attainment of a watercourse designated use which may include physical, chemical, biological and economic factors. The analysis process is defined in: the Revised Water Quality Standards Regulations published in the Federal Register (48 FR 5 1400, November 8, 1983). Additional guidance regarding preparation of Use Attainability Analyses is contained in Chapter 3 of the Water Quality Standards Handbook (EPA - 1983) and Technical Support Manual: Water Body Surveys and Assessments for Conducting Use Attainability Analyses (EPA Office of Water, November 1983). |

| | |
|---|---|
| WATERS OF THE STATE | - Defined in Sec. 22a-423 as, "...all tidal waters, harbors, estuaries, rivers, brooks, watercourses, waterways. wells, springs, lakes, ponds, marshes, drainage systems, and all other surface or underground streams, bodies or accumulations of water, natural or artificial, public or private, which are contained within, flow through or border upon this state or any portion thereof". |
| WATER QUALITY | - A statement of the physical, chemical and biological characteristics of surface or ground waters. |
| WATER QUALITY BASED TREATMENT | - Additional waste treatment defined under the provisions of Section 302 of the Clean Water Act when technology based treatment is not sufficient to protect water quality. |
| WATER QUALITY LIMITED SEGMENT | - Any segment of a watercourse where it is known that water quality does not meet applicable standards and/or is not expected to meet applicable water quality standards even after the application of technology based effluent limitations. |
| WATER QUALITY STANDARDS | - Provisions of state and federal law which consist of designated use or uses for the state's waters and water quality criteria which will support those uses. |
| ZONE OF INFLUENCE | - Spatial area or volume of receiving water flow within which some degradation of water quality or use impairment is anticipated to occur as a result of a pollutant discharge. May be used to describe an area impacted by thermal, conventional, or toxic pollutants. |
| ZONE OF PASSAGE | - Spatial area or volume of flow within which the concentration of toxic chemicals and/or temperature elevations are below levels which would impede or prohibit the passage of free swimming and drifting aquatic organisms. |
| 7Q10 | - (Seven-day, Ten-year low flow) - lowest 7 consecutive day mean stream discharge with a recurrence interval of ten (10) years.<br>[This statistically derived flow rate is exceeded approximately 99% of the time in Connecticut streams. The probability of a 7 day flow of less than the 7Q10 in any given year is approximately 1%. Low stream flows are sustained by ground water inflow as opposed to surface water runoff]. |

## APPENDIX B

## GUIDELINES FOR USE OF COLIFORM BACTERIA CRITERIA

Bacteria of the coliform group reside in the intestines of warm blooded animals including man. The approximate contribution of coliform group bacteria as determined in a metropolitan sewage system, is 160 billion per capita per day. High levels of coliform in water may indicate the presence of human wastes and consequent potential health hazards.

Total coliform bacteria have traditionally been widely used as surrogates to indicate the possible presence of pathogenic organisms normally associated with sewage. Total coliform bacteria are also found in tissues of plants, soils, and the intestines of other warm blooded animals, including common domestic animals. Therefore, the presence of large numbers of coliform organisms is cause for concern but not proof that waters are contaminated with sewage and accompanying pathogenic bacteria.

Fecal coliform bacteria comprise a portion of the total coliform group and are more specific to bacteria found in the intestinal tract of warm blooded animals but not in plants, soils, and other sources which have no sanitary significance.

A major change was incorporated into the last revision of the Water Quality Standards in that fecal coliform was used as the primary criteria for sanitary quality of surface waters. Fecal coliform criteria presented in USEPA Quality Criteria for Water (1976) were used as guidance.

In May of 1984 the U. S. Environmental Protection Agency released a Draft Bacteriological Ambient Water Quality Criteria document (F. R. 1984). When this document is published in final form, it is intended to update and revise the existing EPA criteria document cited above (USEPA 1976). The proposed criteria are based on recent research which examined the relationship between observed incidence of swimming associated illness, and measured ambient densities of various indicator bacteria. As a result of this research, the EPA concluded that the currently recommended indicator organism group, fecal coliforms, should be replaced by two indicators which show a better correlation to swimming related illness.

The recently proposed criteria document recommends that for water contact recreation, *Escherichia coli* and/or Enterococcus be used as indicators for freshwater, and Enterococcus be used as the indicator organism for marine waters.

Connecticut's Department of Environmental Protection and the Department of Health Services are currently evaluating the proposed criteria in terms of their applicability to Connecticut waters. Consideration will be given to incorporation of the proposed criteria into the next revision of Connecticut's Water Quality Standards.

## USFDA BACTERIOLOGICAL CRITERIA FOR DIRECT HARVESTING OF SHELLFISH

For shellfish harvesting areas, the U. S. Food and Drug Administration (FDA) has established the following criteria:

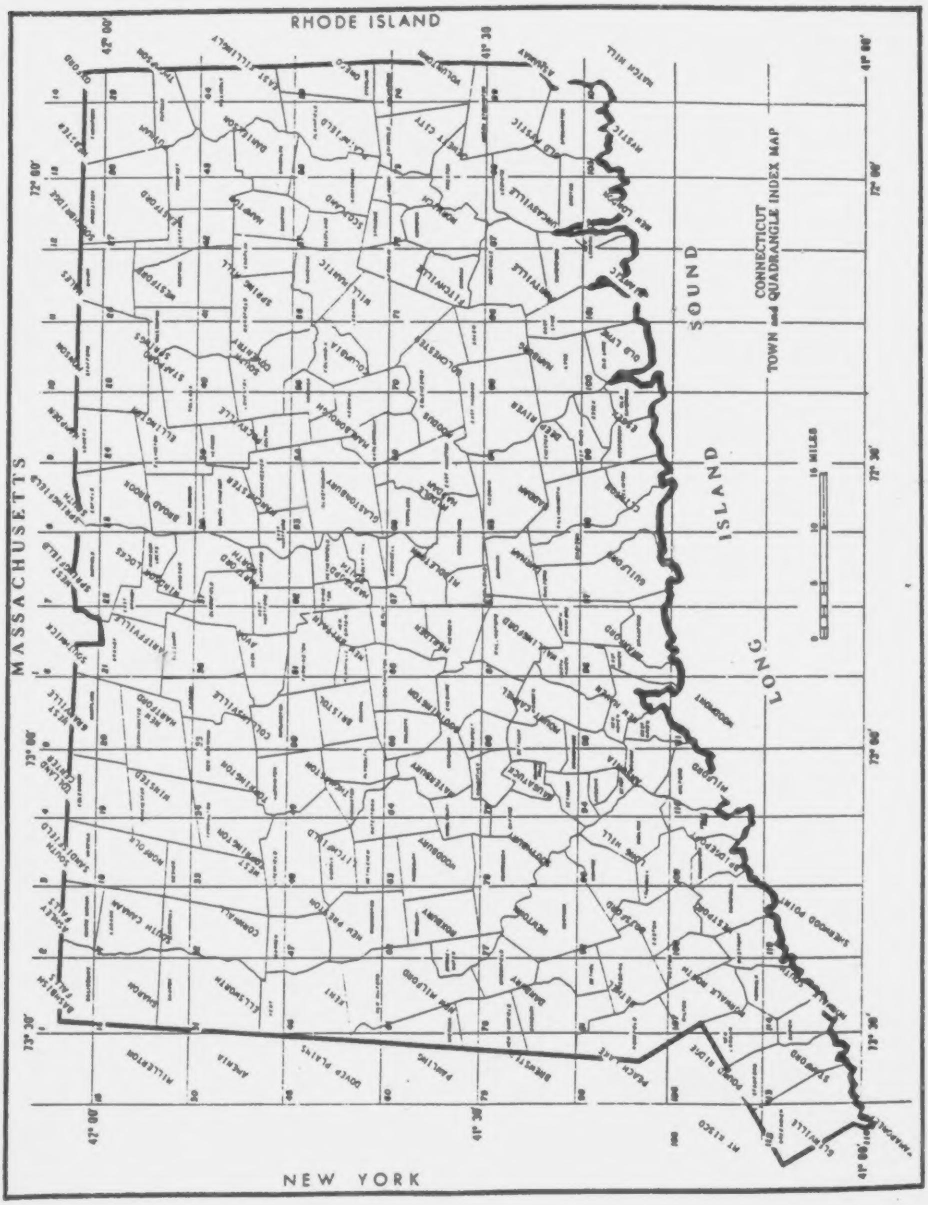
| | |
|---|---|
| Class SA, Shellfish harvesting - | Fecal coliform shall not exceed a median of 14 organisms/100 ml nor shall 10% of samples exceed 43 organisms/100 ml, or:<br>total coliform not to exceed a median of 70 organisms/100 ml nor shall 10% of samples exceed 230 organisms/100 ml. |

At the present time, the State Department of Health Services uses the FDA criteria for Total Coliform. Analysis is performed using the MPN 5-tube decimal dilution procedure. In order to insure an acceptable confidence level, a minimum of 15 samples is required.

## PERMITTED UTILIZATION OF SHELLFISH FROM MARINE WATERS
### by Water Quality Classification

The following restrictions are imposed by the Connecticut Department of Health Services for the Utilization of shellfish from marine waters.

| CLASS | ACCEPTABLE UTILIZATION |
|---|---|
| SA | Direct marketing |
| SB | Depuration and relay (transplant) operations. The U. S. Food & Drug Administration (FDA) would refer to this area as a "Restricted Area Classification", under the National Shellfish Sanitation Program. The FDA interpretation of the bacteriological water quality for a restricted area is:<br>when that area is exposed to fecal contamination during worst pollution conditions, the total coliform median or geometric mean most probable number (MPN) of the water does not exceed 700 per 100ml and not more than 10 percent of the samples exceed an MPN of 2,300 per 100ml for a 5-tube decimal dilution test. |
| SC | Long term relay operations (minimum of one year on Class SA water). This classification would represent waters where pollution loading of shellfish would require considerable renovation. |


CONNECTICUT
TOWN and QUADRANGLE INDEX MAP
RHODE ISLAND
MASSACHUSETTS
NEW YORK
LONG ISLAND SOUND
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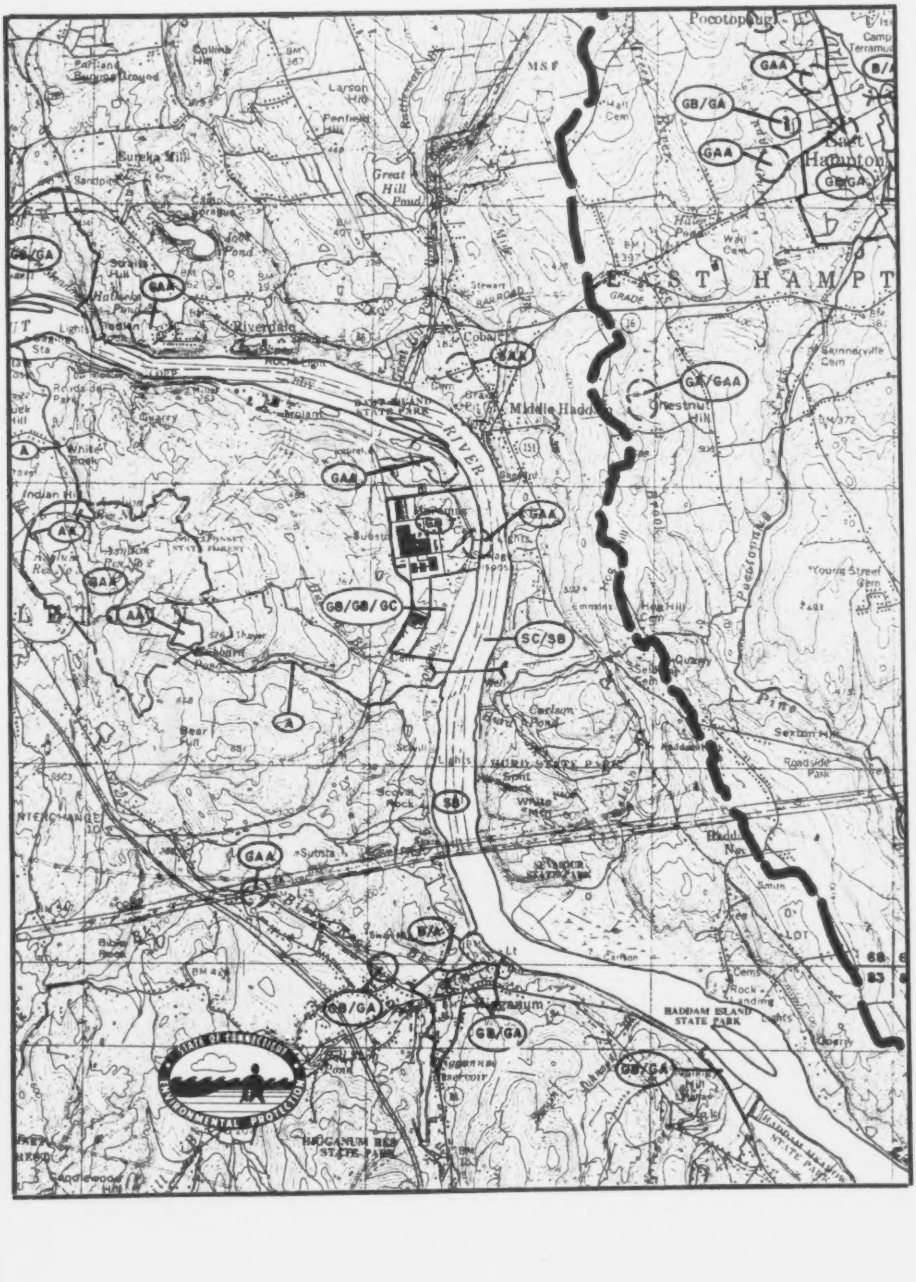
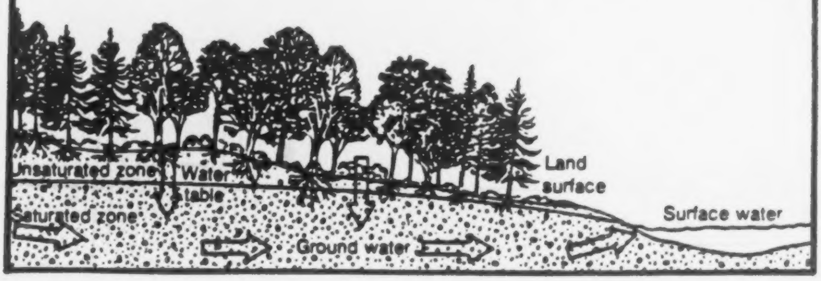
42° 00'
41° 30'
41° 00'
73° 30'
73° 00'
72° 30'
72° 00'


Pocotopaug
GAA
B/A
GB/GA
GAA
East Hampton
GB/GA
EAST HAMPT
Great Hill Pond
Eureka Hill
Collins Hill
Larson Hill
Penfield Hill
GB/GA
GAA
Riverdale
GAA
Cobalt
GB/GAA
Chestnut Hill
Middle Haddam
RIVER
A
White Rock
GAA
Indian Hill
AA
GAA
GB/GB/GC
AA
SC/SB
Hog Hill
Carlson Pond
A
Bear Hill
HURD STATE PARK
Split Rock
SB
Sexton Hill
Roadside Park
GAA
INTERCHANGE
B/A
GB/GA
Higganum
GB/GA
GB/GA
HADDAM ISLAND STATE PARK
HIGGANUM RES STATE PARK
Saddlewood Hill
STATE OF CONNECTICUT
ENVIRONMENTAL PROTECTION

January 1987

# Connecticut's

# Ground Water Protection Strategy


Unsaturated zone
Water table
Saturated zone
Ground water
Land surface
Surface water

**Connecticut Department of Environmental Protection**
**Water Compliance Unit**
**Natural Resources Center**

# CONNECTICUT'S GROUND WATER PROTECTION STRATEGY

"The goal of the state is, wherever feasible, to restore or maintain all ground waters to a quality consistent with its use for drinking without treatment". (CT's Water Quality Standards)

## Introduction

Connecticut's surface and ground water has always been this state's most valuable and reliable natural resource. An abundant supply of clean water assured our commercial and industrial base could develop to its present diversity and strength and because of our abundant water resources, we could contemplate continued economic growth. The citizens of Connecticut have also come to expect potable water would be available when and where needed in the quality and quantities necessary. These are largely still reasonable expectations in most of the state but may not be in the future as our population grows and we expand our land uses in greater densities over a wider area.

Presently, management of the state's drinking water resources is a major responsibility of two state agencies, the Departments of Health Services and Environmental Protection. Though both the quantity and quality aspects have been addressed in numerous pieces of legislation and regulations, it is only within recent years we've become aware of the true nature and extent of the state's water quality problems, especially ground water.

Surface water has historically received the principal attention of federal and state water quality improvement programs as they were the most used and obviously, most abused waters. Ground water on the other hand, the water supply source for one-third of Connecticut's residents, has only recently become the subject of serious concern. Until now, ground water has been protected from the most serious and obvious sources of pollution through existing federal and state water quality management programs. Now however, we recognize that a clearly identified and comprehensive ground water protection strategy is warranted if we are to address all the real risks to our irreplaceable drinking water supplies.

This document has been prepared to integrate and describe all the elements of our state's comprehensive quality management effort and to note where improvements in existing programs are required and where new initiatives would enhance the efficiency and effectiveness of our protection efforts.

## GROUND WATER USE

Connecticut is the third smallest, fourth most densely populated state in the nation, one of the most industrialized, and in which thirty two percent of its three million residents rely upon ground water as a principal drinking water supply source. In Table 1 we can see the nature of this reliance, the number of community wells, non-community wells (serving restaurants, schools, hospitals, factories etc.) and individual home wells. What is perhaps most remarkable about this data is simply the large number of holes in the ground which have been dug and drilled throughout the state and that many thousands more are being created every year.

Table 1
Groundwater supply statistics
(1985) Data

| Supply Source | Pop. Served | % of Population | Water Withdrawn | % of all Water Drawn From all sources |
|---|---|---|---|---|
| 1400 Community Supply Wells | 518,190 | 16.2 | 65.6 MGD | 16% |
| 250,000 Individual Home Wells | 514,990 | 16.1 | 38.6 MGD | 10% |
| Total | 1,033,180 | 32.3% | 104.2 MGD | 26% |

Because so many wells are expected to supply so many people in so many areas, it is essential water quality protection programs recognize the different qualitative and quantitative features of the state's natural ground water resource. The following will describe the basics of Connecticut's hydrologic and geologic system. This information will serve as a reference point when the detail of water quality protection strategies is presented in the latter part of this document.

HYDROLOGIC CYCLE

The movement and storage of water in our environment is a natural process called the 'hydrologic cycle'. This is illustrated in Figure 1. The cycle's starting point begins with the condensation of atmospheric moisture and its precipitation as rain or snow. Water striking the ground either quickly sinks into the soil or runs overland to streams and other surface water bodies. The water which infiltrates into soil materials, will percolate downward, reach the water table and then mix in with other water.

The earth material which lies above the water table is termed the unsaturated zone because all the soil pore space is not filled with water. The zone lying below the water table is termed the saturated zone because all pore space is filled with water. All the water lying within both the unsaturated and saturated zones is called ground water, and at any one time, may be held in place, move downgradient to springs, streams, wetlands and lakes be taken up by plants or pumped to the surface in wells. All ground water eventually returns to the atmosphere. The time that trip takes depends upon how long a pathway the water takes and the material it must pass through is before it allowed to resurface.

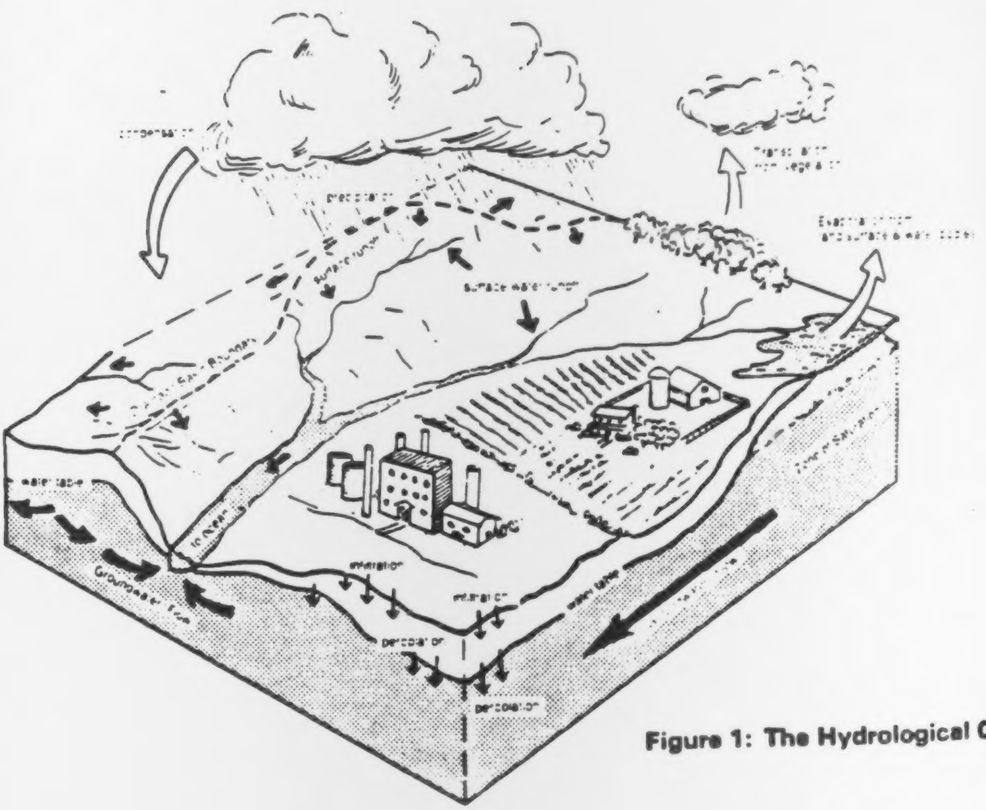

condensation
transpiration from vegetation
precipitation
evaporation from land surface & water bodies
surface runoff
surface water runoff
basin boundary
zone of saturation
water table
to ocean
Groundwater flow
infiltration
infiltration
water table
percolation
percolation

Figure 1: The Hydrological Cycle

## GROUND WATER RESOURCES

The general public's perception of ground water is that it can only be found in great quantities in a few scattered geologic formations called "aquifers". In fact, the entire state is an aquifer, for the technical meaning of that term is to describe geologic conditions where water can be withdrawn in usable quantities. That technical definition applies to all of Connecticut as is corroborated by the data in Table 1.

There are, however, two principal types of aquifer formations in Connecticut; bedrock, composed of the hard rock underlying the entire state, and stratified drift deposits in valleys, composed of unconsolidated sands and gravels of glacial origin which were transported and deposited by streams and rivers.

Stratified drift aquifers are the highest yielding ground water sources in Connecticut and because of their origin, are associated with river valleys. Most deposits in the state's uplands appear as long thin bands, while in the lower lying and broad river valleys, they may be quite extensive and deep. The natural quality of water drawn from these sediments is generally excellent.

Bedrock aquifers underlie the entire state and are the principal water source for most suburban and rural areas. The yield of this aquifer type is generally much lower than that derived from sand and gravel areas. The quality of water drawn from bedrock is generally higher in dissolved minerals than water drawn from stratified drift and in some areas, naturally occurring iron, manganese, hardness or sulphur may be objectionally high. Fortunately, in most areas, the quality of ground water in bedrock is suitable for direct human consumption.

## GROUND WATER MANAGEMENT CONCEPTS

Within the past few years, for administrative purposes, the DEP brought into the traditional description of Connecticut's ground water resources, a general characterization of their actual or potential yield and value. We now can characterize our ground waters as occurring in:

1) High yield aquifers - Those stratified drift aquifer areas which may yield approximately 5 million gallons per day or greater without adversely affecting stream flow.

2) Moderate yield aquifers - Those stratified drift aquifer areas which may yield sufficient quantities of water to be an important resource as either local or regional public water supplements.

| | |
|---|---|
| 3) Other ground waters - | Essentially the bedrock - till aquifer system throughout the state which is the principal supply for individual homes and small community and non-community water systems serving suburban and rural areas. |

Approximately 38 high yield aquifer areas have been identified across the state and about 120 areas have been noted as moderate yield aquifers. These areas are the subject of a special study mandated by Public Act 85-84 and their use, capacity and protection are more fully described in another report entitled "Protection of High and Moderate Yield Stratified Drift Aquifers".

GROUND WATER QUALITY DEGRADATION

Contaminated wells have been identified in 100 of Connecticut's 169 towns. Table 2 presents the most recent assessment of the contaminant sources.

Table 2
Contaminated Well Incidents
(Approximate Numbers updated to February 1987)

| Pesticides | Solvents | Land Fill Leachate | Gas & Oil | Road Salt | Nitrates | Other | Total |
|---|---|---|---|---|---|---|---|
| 417 | 255 | 139 | 163 | 61 | 95 | 25 | 1155 |

Fortunately, state government has been able to respond to these incidences through emergency measures such as provision of bottled water until longer term solutions, such as water main extensions to affected areas or installation of filters or treatment systems can be implemented.

PESTICIDES

As can be seen in Table 2, the majority of wells were polluted by pesticides, specifically the tobacco field fumigant EDB. Fortunately, the location and extent of this pesticides' use is known and the problem can be considered localized. Also, the use of EDB is no longer allowed. Another pesticide of concern, Vorlex, has been used as a fumigant on strawberry fields as well as tobacco and testing of areas so treated indicates it too has the potential to contaminate drinking water supplies, although the full extent of Vorlex contamination has yet to be determined.

SOLVENTS

The class of chemicals termed solvents are increasingly becoming a matter of concern. They appear in a large number of consumer products and as components in numerous commercial and industrial processes. These synthetic organic chemicals, because of their ubiquitous use, are one of the principal reasons the state DEP considers certain commercial, and most industrial land uses, as high risks to ground water quality.

At this time, the Department of Environmental Protection scrutinizes the chemical storage, use and disposal practices at those facilities which are being regulated as wastewater dischargers or as hazardous waste generators. Technical guidance is provided to owners and operators of these facilities on safe and preferred chemical handling practices. Should contamination be discovered, existing state laws allow the DEP to require the clean up of such contamination and to require that any contaminated drinking water supply be replaced with a safe supply. This enforcement and technical direction should limit the spread of contamination which could be attributed to new facilities.

In addition, municipalities are being advised of the risks inherent to certain commercial and most industrial facilities and of those contaminant sources common to residential uses. This planning assistance, which encourages consideration of ground water protection in planning and zoning decisions, should greatly diminish the incidences of well water contamination from synthetic organic chemicals emanating from facilities improperly sited near water supply sources.

## LANDFILLS

Landfill leachate, though having proved to be a definite ground water contaminant wherever encountered, should prove less of a concern in the future. Almost all solid waste disposal sites in Connecticut have been located and the extent of ground water contamination mapped. Stringent regulation of all existing and future solid waste disposal, with particular detailed assessment of ground water impacts, will largely remove landfill leachate as a well water concern. Of course, treatment or abandonment of existing contaminated wells and judicious placement of future wells, should be particularly effective in diminishing concerns.

## OIL AND GASOLINE

The storage, transmission, use, disposal and spillage of fuel and lubricating oils will likely continue to be a principal ground water contaminant. Existing federal and state regulations do not as yet provide adequate ground water protection. Restrictions have been placed on the types of chemicals which can be regulated, on the size and type of storage container, whether containers are above or below ground and for what purpose the chemical is used. Perhaps the most worrisome concern for this class of chemical is the underground storage of home heating oil in unprotected steel tanks. Though this volume of oil may be relatively small, its widespread underground storage in many residential areas is troubling.

## NITRATES

Nitrate contamination in Connecticut has largely resulted from the improper storage and spreading of animal manure and from fertilizer applications on agricultural lands and increasingly, on landscaped areas. Though this contamination poses a real health risk to sensitive individuals, the nitrates are not overly persistent in ground water while the sources are obvious and readily controlable. Application of Best Management Practices for the storage and use of both animal wastes and fertilizers will limit the severity and extent of this problem.

## ROAD SALT

Highway deicing agents have been a concern in certain areas but new regulations on the storage and use of road salt and salt-sand mixtures will greatly diminish the incidences and extent of these problems.

## OTHER

The "other" category, consists of exotic and now relatively uncommon chemicals such as phenols, PCB's and bacterial and viral contamination. It does not appear this general class of contaminant will either dramatically increase or decrease in its appearance. Future careful siting of high risk land uses, regulation of the storage, use and disposal of all chemicals, the provision of adequate sewerage and water utility service where needed, should together lessen the concerns which could be attributable to this contaminant group.

We must, however recognize that as as we increase our understanding of the health risks posed by ever increasingly small concentrations of more chemicals and we extend our testing of more and more ground waters, the severity, extent and number of contamination incidences will increase.

## GROUND WATER QUALITY CLASSIFICATIONS

Connecticut's water quality standards are perhaps the most significant water quality protective force in the state. These standards clearly and forcefully declare state policy is to restore and maintain all waters to a condition suitable for their designated uses. All drinking water supplies are noted as meriting the greatest degree of protection and shall be maintained in an uncontaminated, readily potable condition. A water quality classification system identifies quality conditions for all waters and the quality goals. The following statistics provide a brief overview of groundwater conditions statewide.

| Class | Acres | % State | Water Use |
|---|---|---|---|
| GAA | 715,488 | 22.0 | Uncontaminated public water wells and watersheds |
| GA | 2,208,703 | 69.7 | Uncontaminated private water supply |
| GB | 128,570 | 4.0 | Degraded ground waters not used as supply source |
| GB/GAA<br>&<br>GB/GA | 71,565 | 2.0 | Degraded ground waters used as public or private supply source |
| GB/GB/GC<br>&<br>GA/GA/GC | 9,517 | 0.3 | Ground waters not used as public supply and may be degraded.<br>Potential wastewater treatment site |

This summation demonstrates the prevalence of uncontaminated ground water in Connecticut and, of those areas now tainted, almost all are scheduled for restoration to drinking water quality conditions. The state's policy of prohibiting almost all discharges to almost all ground waters is perhaps the single, most important mechanism for preventing contamination of drinking water supplies. Continuation of this ground water goal, coupled with stringent regulation on the storage and disposal of waste materials and the storage and use of hazardous materials in residential, commercial, and industrial facilities and appropriate land use decisions by municipalities, should greatly reduce the threats to our drinking water supplies.

## A COMPREHENSIVE APPROACH - CONNECTICUT'S STRATEGY

Figure 1 illustrates a very important concept; ground water is "downhill" of everything else on the landscape. All land and water uses will cause some impact on ground water quality and quantity. They may be slight and not readily noticeable, but they will occur. Recognizing this, the Departments'of Health Services and Environmental Protection have, over the years, developed a large number of diverse measures to protect ground water.

In the following Tables, these regulatory and non-regulatory programs are detailed. It is worth noting in reviewing this data that Connecticut's comprehensive approach to ground water protection, employing the efforts of both state and local government is considered a national model. Though there is always opportunity to improve and expand our programs, the citizens of Connecticut should be proud their government has accomplished so much in so short a time with such ingenuity.

The specific elements of our strategy range from technical guidance in land and water use planning and suggestions for Best Management Practices to detailed permit programs with stringent performance standards and, in some cases, outright bans on the use of certain products. Table 3 describes the 14 program elements which are applied statewide by virtue of specific statutory authorities, and Table 4 describes the 7 program elements which directly pertain to a specific region of the state and to individual municipalities.

### STATEWIDE PROGRAMS

- Drinking Water Standards
- Water Quality Standards and Classifications
- Source Controls
- Enforcement
- Statewide Bans
- Best Management Practices
- Victim Compensation
- Planning
- Water Use and Allocation
- Monitoring
- Research
- Data Management
- Local Assistance
- Education

### REGIONAL & LOCAL PROGRAMS

- Land Use Controls
- Aquifer Identification
- Performance Standards
- Well Protection
- Household Hazardous Waste
- Local Monitoring, Inspection and Enforcement

## TABLE 3

### EXISTING GROUNDWATER MANAGEMENT PROGRAM

Connecticut's Clean Water Act which is embodied in Chapter 446k of the Connecticut General Statutes (CGS); and the State's Drinking Water Program which is set forth under Chapters 368a and 474 of the CGS provide the foundation for the state's groundwater management programs. The legislation establishes broad regulatory powers within the Department of Environmental Protection for the control of pollution, including the authority to protect groundwaters, calls for the development of statewide water quality standards and classifications, and provides authority for enforcement actions against waste discharges to the ground; and within the Department of Health Services for use and protection of groundwaters for potable supply. A Memorandum of Agreement for Groundwater Management between the Departments of Health Services and Environmental Protection is intended to coordinate the activities of the agencies with respect to groundwater management.

| PROGRAM ELEMENT | SUMMARY DESCRIPTION | EXISTING STATUTES AND REGULATIONS | RESPONSIBILITY | ADDITIONAL NEEDS |
|---|---|---|---|---|
| DRINKING WATER STANDARDS | Establish quality standards for use and protection of groundwater for potable supply. Used as a basis for permits and clean up. Risk assessment is used in setting criteria. | 19a-36 Public Health Code<br>19a-37 Wells and Springs<br>25-32 | DHS | Establish drinking water standards for individual private wells. |
| WATER QUALITY STANDARDS AND CLASSIFICATIONS | Classifications are intended to protect drinking water supplies and provide for waste disposal. Areas suitable for waste disposal have been identified based on hydrogeologic conditions. Classification maps and waste source inventory maps are suitable for local use and have been distributed to the towns. Classifications used to regulate siting of land disposal facilities. | 22a-426<br>EPA Wellhead Protection Program | DEP | Relate Water Quality Standards and Classifications to protection of high and moderate yield aquifers. |
| SOURCE CONTROLS | Potential sources of contamination are controlled under variety of programs. Examples include point source discharges, landfills, septic systems. Consistency with Water Quality Standards required. Other controls include an emergency spill response fund; provision for containment and removal costs; provisions for liens against real property. | 22a-427 to 438<br>22a-454 Property transfer<br>22a-449 Leaking Underground Storage<br>22a-208 Solid Waste<br>22a-114 Siting Council<br>22a-46, 22a-66z Pesticides<br>22a-452a Superlien<br>22a-451 Spill response fund<br>22a-452 Reimbursement for containment and removal costs<br>EPA Wellhead Protection Program | DEP | |
| | Well drilling permits are required and siting and construction standards must be adhered to. | 25-130 Well drilling<br>19-13-51b Health Code | CP<br>DOHS | Revise Well Drilling Code |
| ENFORCEMENT | Administrative, civil and criminal penalties are all utilized for enforce- of water pollution, hazardous waste, and various clean-up program regulations. Super Lien is available as an enforcement tool. | Chapter 446k | DEP | |

| PROGRAM ELEMENT | SUMMARY DESCRIPTION | EXISTING STATUTES AND REGULATIONS | RESPONSIBILITY | ADDITIONAL NEEDS |
|---|---|---|---|---|
| WIDE BANS | Statewide bans are established for certain substances known to pose serious risks. Examples include bans on all septic system additives which contain toxic or hazardous substances; for PCB's; some detergents and certain pesticides. | 22a-461 to 469 (PA 85-77)<br>22a-61 | DEP | |
| BEST MANAGEMENT PRACTICES | Leaking underground fuel and chemical storage tanks regulated and design standards adopted. Non-point source control on fertilizer and integrated pest management are in place. Integrated pest management is presently voluntary. Spill prevention plans are part of new industrial permits. Household hazardous waste collection day funding is provided to towns. Road salt storage and and application is regulated. | 22a-449(PA 83-142)<br>22a-430<br>PA 85-450 | DEP | Expand integrated pest management program |
| VICTIM COMPENSATION | Potable water is provided to residents with contaminated drinking water; funding is provided for engineering studies to identify solutions for correcting contamination problems; municipalities are required to implement solutions; grants and loans are provided to municipalities for implementation. Provisions apply to cases where no responsible party for pollution has been identified. The property transfer law contains provisions for clean-up of industrial lands prior to real estate transfers. | 22a-471 Potable Water (PA 86-407)<br>22a-454 Property Transfer (PA 85-88) | DEP | Shorten timeframe for implementation of final solutions for provision of potable water. |
| PLANNING | Annual Water Quality Management Plan and specific Basin Management Plans are the primary tools. The State Conservation and Development Policies Plan, the Long-Range Water Resources Management Planning Process, and the State Environmental Plan all address groundwater issues. Individual utility water supply plans and coordinated regional water supply plans are required, and will address groundwater issues. Local plans and zoning are required to address water supply protection; and the state may review local zoning decisions for proposed activities affecting existing and potential water supplies. | Sec. 303 Clean Water Act<br>Sec. 303E Clean Water Act<br>16-26 C&D Policy Plan<br>22a-352 Long-Range Water Plan<br>22a-8 State Environmental Plan<br>25-32d Individual Water Supply Plans<br>PA 85-535 Connecticut Plan<br>8-23 (PA 85-279) Local Plans<br>8-35 Regional Planning Agency Plans<br>7-246 Pollution Control Authorities | DEP<br>DEP<br>OPM/Legis.<br>DEP/OPM/DHS<br>DEP<br>Utility<br>St/util/RPA<br>MUN<br>RPA<br>MUN | |
| WATER USE AND ALLOCATION | Permits required for withdrawals in excess of 50,000 gallons per day. Evaluation of impacts on surface waters and on other uses is required. Minimum stream flow regulations | 22a-365 Diversion<br>26-141a Minimum Flows | DEP<br>DEP | Process for reservation of resources for future use. |

| PROGRAM ELEMENT | SUMMARY DESCRIPTION | EXISTING STATUTES AND REGULATIONS | RESPONSIBILITY | ADDITIONAL NEEDS |
|---|---|---|---|---|
| WATER USE AND ALLOCATION (continued) | Requires maintenance of flows (derived from groundwater base flows). Utilities are regulated with respect to planning, quantity and quality of supply, rates and service. Certain resources are allocated for waste disposal under Water Quality Classifications. Cooperative Water Use Information Program maintains information on surface and groundwater use for a variety of applications. | 19-13 Health Code<br>22a-426 Classifications | DHS/DPUC<br>DEP | |
| MONITORING | Ambient network maintained for quality trends at 1,200 public water supply wells. Monitoring also required at all permitted discharge sources and disposal sites, and along plumes. Groundwater levels are monitored under a cooperative program with the USGS. | 19-13-B102<br>22a-431 | DHS<br>DEP | |
| RESEARCH | A study of significant high and moderate yield stratified drift aquifers is currently underway to identify and protect those resources for future use. A study of pesticide distribution and potential for contamination of drinking water supplies is ongoing. Inventory of groundwater resources is ongoing. | SA 85-84<br>PA 86-44<br>22a-351 | DEP<br>DEP<br>DEP/USGS | Research is needed on flow physics of bedrock and till systems. Complete identification moderate and high yield aquifers. |
| DATA MANAGEMENT | Computerized geographic information system is being developed for data management. Inventory of all base maps of water quality sources, public wells, bedrock, stratified drift, till, water table contact, land use and zoning, are maintained and developed. Water use inventory is maintained. | | | |
| LOCAL ASSISTANCE | Groundwater management manual prepared for local officials. DEP assists local governments in planning for aquifer protection. Technical documents containing suggested best management practices and performance standards are prepared, and available for local adoption. DEP may delegate state permit inspection and enforcement authorities to municipalities. | PA 85-279 Local Plans/Zoning<br>PA 83-237 Delegation | MUN<br>DEP/MUN | Private well strategy is needed. Assistance for local aquifer protection planning is needed. |
| EDUCATION | Articles on Groundwater issues are part of DEP's Citizen's Bulletin, a monthly publication. guidance materials have been prepared for use at meetings and lectures. Household hazardous waste program includes school curriculum, collection days, advertising and literature distribution. | PA 86-288 Disposal Days | DEP<br>MUN | Develop curriculum on groundwater resources and protection for schools. Develop education program for owners of individual private wells. Designate non-toxic alternatives. |

## TABLE 4

### REGIONAL AND LOCAL GROUND WATER MANAGEMENT PROGRAMS

Authority for the management of surface and ground waters at the regional and local level is quite diffuse. Regional planning organizations (Regional Planning Agencies, Councils of Government, Councils of Elected Officials) are required to plan for the conservation and development of resources and to review and comment on major land and water use proposals which are of regional significance. Water Utility Coordinating Committees are required to plan for development and use and protection of drinking waters on a regional basis. Municipalities are mandated to consider protection of their drinking water supplies and can do so through zoning and subdivision regulations, town ordinances and other measures.

| ELEMENT | SUMMARY DESCRIPTION | EXISTING STATUTES AND REGULATIONS | RESPONSIBILITY | ADDITIONAL NEEDS |
|---|---|---|---|---|
| LAND USE CONTROLS | Actions which can be implemented at a regional or local level include: consideration of groundwater protection in local plans of development and in local zoning; inclusion of state water quality classifications in local plans of conservation and development. | 8-23 local plans<br>8-35a regional plans<br>7-246 WPCA's<br>7-131 municipal forests<br>7-131b Aquisiton of open space<br>22-26aa Agricultural Land Pres.<br>8-2 zoning | MUN<br>RPA<br>MUN<br>MUN<br>MUN<br>DAG | Improved coordination for protection of aquifer resources which transcend town boundaries. |
| AQUIFER IDENTIFICATION | Identification of geologic formations as actual or potential withdrawal sites through detailed hydrogeologic studies. Designation of stratified drift deposits and select bedrock formations as regionally significant or locally significant aquifers. | SA 85-84 Aquifer Study<br>25-32d Utility plans<br>USGS/Cooperative: Towns can contract with USGS for ground-water investigations | DEP<br>Util. | Complete identification of high and moderate yield aquifers. Identify bedrock flow systems. |
| AQUIFER PROTECTION | Regulatory and non-regulatory management techniques are applied to geographic areas which have been identified as principal withdrawal sites. Examples include: aquifer protection zones; land acquisition; conservation easements; purchase or transfer of development rights; performance controls on land and water uses. | PA 85-315 Rate treatment<br>25-37 Land Classification<br>25-33 Abandonment<br>8-23 Local Plans<br>22-26aa Agricultural Preservation<br>7-131(a) Mun. Forests<br>7-131(b) Aqisition of Open Space<br>7-148(b) Local Ordinances<br>8-2 Zoning | DPUC<br>DHS<br>DHS<br>MUN<br>DAG<br>MUN<br>MUN<br>MUN<br>MUN | Full implementation of local aquifer protection programs. |
| PERFORMANCE STANDARDS | Detailed controls on the storage, use and disposal of materials, products and wastes and detailed standards on the siting, construction and maintenance of facilities and support features. The state provides guidance in the form of suggested Best Management Practices which the towns may incorporate in the form of zoning regulations or ordinances. | 7-148 Ordinances<br>8-2 Zoning<br>Health Code<br>Building Code<br>Well Drilling Code<br>29-307a(85-162) Max. Material in mfg. establishments<br>31-40m Information requirements of supplier of toxic substances | MUN<br>MUN<br>DOHS<br>DPS<br>DCP | Full implementation of local programs. |

| PROGRAM ELEMENT | SUMMARY DESCRIPTION | EXISTING STATUTES AND REGULATIONS | RESPONSIBILITY | ADDITIONAL NEEDS |
|---|---|---|---|---|
| WELL PROTECTION | Quality assurance of private, homeowner wells is sought through the traditional consideration given to well siting, construction and testing; setback requirements; issuance of certificates of occupancy; and inspection of withdrawal and delivery systems. | Public Health Code<br>Well Drilling Code<br>State Basic Building Code<br>Local Codes | DOHS<br>Well Drilling Board<br>DPS<br>MUN | Development of Private Well Regulations. |
| HOUSEHOLD HAZARDOUS WASTES | Household hazardous material use and disposal is manageable through information and education programs; a household hazardous materials collection program; and designation of non-toxic alternative products. | PA 86-208 | DEP | Full implementation of collection days. |
| LOCAL MONITORING, INSPECTION, AND ENFORCEMENT | Assuring compliance with regulatory and non-regulatory management initiatives. Local program elements are accomplished through designation of enforcement agents and detail of their inspection responsibilities, applicable enforcement standards, authorities and penalties. | PA 83-237 Delegation<br>Fire Marshal<br>Building Official<br>Zoning Enforcement Officer<br>Local Director of Health | DEP | Expanded delegation of authority. |

## HIERARCHY OF LAND USES OVER HIGH AND MODERATE YIELD AQUIFERS

DEP Proposal - to be Used for Discussion Purposes
January, 1987

### Preface

Additional programs are needed to augment the State's comprehensive ground water strategy. The program elements requiring further development relate to the protection of specific geologic formations, and areas within these formations which have the potential for supplying large quantities of ground water. In Connecticut, these resources are coarse grained stratified drift aquifer, and these relatively shallow deposits are highly vulnerable to contamination. For management purposes, two categories of stratified drift aquifers can be identified for which new protection programs should be considered:

> "high" yield aquifers, those aquifer areas which may yield approximately 5 million gallons per day or greater without adversely affecting stream flow; and
>
> "moderate" yield aquifers, those aquifer areas which may yield sufficient quantities of water to be an important resource as either local or regional public water supplements.

On the basis of studies conducted pursuant to Special Act 85-84 and experiences with ground water contamination problems, DEP has reported (see "Protection of High and Moderate Yield Stratified Drift Aquifers", dated January, 1987) that additions to Connecticut's ground water management program should be considered and possibly include:

1. Protection of potential high and moderate yield wellfields for public water supply;
2. Strict regulation of drawdown areas immediately adjacent to potential high and moderate yield wellfields where potential contamination sources would be most threatening; and
3. Management of the recharge areas of high and moderate yield aquifers.
4. State surface and ground water protection strategies in indirect recharge areas.

Implementation of new programs to manage wellfields, drawdown and recharge areas, could involve three primary techniques: land acquisition, land use regulation to prevent the siting of threatening activities, and careful monitoring and regulation of particularly threatening land use activities, such as commercial and industrial development. In broad outline, these techniques could be used in the following fashion:

Wellfield Protection. Potential wellfields could be purchased and carefully managed to prevent any activities which might contaminate them. Existing wellfield sites may also benefit from addition land purchase. Wellfield sites are sufficiently small in size and limited in number that public acquisition or mandatory acquisition by water utilities should be seriously considered. Until potential wellfields are developed for water supply, these sites may also offer recreational opportunities for open space, playing fields and passive recreation.

Protection of Drawdown Areas The land under which the ground water have been lowered due to well pumping can be referred to as the "drawdown area". Ground waters in drawdown areas may flow more rapidly to a wellfield due to effects of gravity and hydraulic gradient. These areas are highly susceptible to contamination and therefore are in need of stringent protection.

Acquisition is the best way to protect drawdown areas. However, because of their more extensive acreage, acquisition of "drawdown areas" will often be precluded by cost. Where acquisition is not feasible or is limited to a portion of the drawdown area, strict regulation of both future and existing land uses could be required.

Existing uses located in drawdown areas could be carefully inspected. Those uses which are found to be threatening could be stringently regulated, by means of mandatory best manageement practices or performance standards, with follow-up inspections to insure that storage, use and disposal of potential contaminants does not cause pollution. Special attention could also be given to developing techniques for phasing out existing incompatible uses, as a means to reduce long term risks.

Future uses located in drawdown areas could also be carefully reviewed to prevent the siting of incompatible land uses which have a high potential to pollute, or to minimize risks by means of mandatory best management practices or performance standards.

Protection of "Recharge Areas" relates to relatively large geologic formations which allow rain and surface water to replenish the drawdown area by ground water flow. Such areas could also be subject to special regulation to prevent, or minimize the risks of ground water contamination. Both future and existing uses of these aquifer recharge areas could come under scrutiny similar but, perhaps less stringent than that accorded uses of drawdown areas.

Protection of "Indirect Recharge Areas" Land upgradient of the wellfield that replenishes the recharge or drawdown areas through natural or induced infiltration from surface water flow over the aquifer(i.e. the remainder of the drainage basin that supplies water to the watercourse that flows over the aquifer). Water quality protection of the indirect recharge areas is largely attained through surface and ground water protection strategies, however, voluntary municipal land use controls and individual best management practices will afford additional protection to these areas.

The following "Hierarchy of Land Uses" could provide the basis for land use decision making in approved drawdown and recharge areas for high and moderate yield aquifers. Although this ranking may have some validity for general ground water protection, it is not to be taken as an absolute prohibition of any activity on a town-wide basis. Different hydrogeologic systems have different physical capabilities and social-economic circumstances must be taken into consideration when planning for and regulating water supply systems, waste disposal and land use development.

The "Land Use Hierarchy" is based on several premises which must be kept in mind while reviewing this document.

1. Risk assessment during the location of facilities which pose a threat to aquifers must be considered. If a potential source, such as an industry, is to be located anywhere where ground water supplies may be contaminated, then all appropriate institutional controls should be utilized to provide protection. If a proposal passes these tests, then consider the result of failure of those controls. If failure would contaminate 1 or 6 or 12 individual wells, that would be tragic, but remedial measures are in hand, are workable, and will work better in the future. If, however, the result of failure is contamination of a high or moderate yield aquifer, then the impact may have regional or statewide implications.

2. Pollution comes in may forms, but the "Hierarchy of Land Uses" is based on the presumption that normal domestic sewage and animal wastes are natural in origin, not persistent, and must be present in large quantities to seriously impact the potability of ground water, especially in the high and moderate yield aquifers. Furthermore, these are substances that will degrade and be removed in a timely manner if the source is removed.

The contaminants of greatest concern are those that are persistent, toxic or hazardous, organic or inorganic chemicals which, in very low quantities, render water non-potable. Drinking water standards are not established for many of these potential contaminants, the Federal Environmental Protection Agency is, however, charged with the task of establishing new drinking water criteria for a host of the more common contaminants in the next three years.

Category A: Land uses which provide maximum protection to high and moderate yield aquifers

These types of land use are the most desirable in terms of providing passive protection to a ground water resource. These activities or uses tend to have very limited discharges of pollutants, and are deemed least likely to have inadvertent spills and incidences which could degrade an aquifer. An additional inherent control is that these uses involve large holdings, usually by a governmental entity, a utility, or by a single owner, thus making regulatory oversight easier.

Category A Land Uses

A.1. Land owned and maintained by a water utility as a water supply area

A.2. Designated open space, passive recreation with no permanent facilities

A.3. State or local government-owned forest land

A.4. Managed forest land, privately owned

A.5. Developed recreational use, public parks (excluding active recreational areas such as golf courses)

**Category B: Land uses posing minimal risks to high and moderate yield aquifers**

These land uses pose some risk to ground water; however, the risk is slight and can be mitigated by the nature of the operation or development. This category has the benefit of providing dollar return to the land-owner and tax revenues to the towns, while providing good protection. While the economic concern should not be paramount, these uses are not uncommon, are productive, and are feasible. They probably offer the maximum protection with minimum land-owner or taxpayer resistance.

**Category B Land Uses**

B.1. Field crops

a) permanent pasture
b) hay crops
c) corn
d) vegetable production

Mitigating Measures: Such uses in approved drawdown or recharge areas could be subject to more frequent inspections by DEP (or delegated municipal agent) and the water utility. Agricultural technical service agencies such as SCS and the Extension Service could be requested to give priority to work with farmers to ensure that Best Management Practices (BMP's) for fertilization and pesticides application practices are developed and used. In approved drawdown areas, and possibly recharge areas as well, conideration could be given to mandating the use of such BMP's.

B.2. Low-density residential/certain institutional uses (density of 1 dwelling unit per two acres or less)

Restricted institutional uses might include churches, municipal offices, and similar facilities which are unlikely to produce discharges at a higher level than anticipated from low-density housing, and where laboratory facilities, photo-processing, and industrial source generation usage or spillage is unlikely. Restricted institutional uses should be held by responsible civic, non-profit operations, as a further control on building use.

Mitigating Measures: Approved drawdown and recharge areas could be subject to inspections by the water utility or municipality for potential problems, and educational programs to minimize chance of contamination. Underground storage and transfer of fuel could be prohibited in approved drawdown areas. Sanitary sewers are not recommended as a mitigation measure.

**Category C: Land uses which pose slight to moderate risks to ground water**

The pollutants generated intentionally or inadvertently by these land uses should be similar in nature to those in Category B. The density in this category calls for more refined evaluation of the anticipated pollutant loadings on the ground water. Of more importance is the fact that the density statistically increases the chances of serious inadvertent contamination with toxic persistent material, resulting in potential economic and public health impacts and concerns.

**Category C Land Uses**

C.1. Agricultural production

a) livestock, e.g. dairy, poultry, etc.

Mitigating Measures: In approved drawdown areas, and possibly recharge areas as well, BMP's could be made mandatory. Prior to enforcing requirements, technical assistance from State and Federal agricultural agencies could be given priority consideration.

b) tobacco crops, nurseries and orchards

Mitigating Measures: same as C.1.A) above

C.2. Golf Courses

Mitigating Measures: Inspections, possible monitoring of fertilizer and pesticides use.

C.3. Medium-density residential (density ranges from more than 1 dwelling unit per 2 acres to 1 unit per 1/2 acre)

Mitigating Measures: In the approved drawdown area, provision of sanitary sewers may be considered a mitigating measure, provided such service is accompanied by zoning restrictions which prohibit land use changes that might increase the potential for toxic discharge to the ground water. Sewer construction in drawdown areas could be required to conform to best engineering practices (such as required for sewers in water supply reservoir watersheds) for minimizing exfiltration. Surveys by the water utility, municipality or DEP, could be performed. Zoning could be used to eliminate cottage industries. Educational programs to minimize nonpoint problems such as car degreasing and motor oil disposal, and residential fertilizer or pesticides abuse, could be performed. In approved drawdown areas, and possiby recharge areas, underground fuel storage could be banned. Stormwater controls for streets and parking areas should not be designed to maximize ground water recharge.

**Category D: Land uses considered to pose a substantial risk to ground water**

Land uses in this category pose a substantial risk to ground water. Some of these land uses pose risks associated with this category simply because of the density and level of human activity offering the opportunity for unanticipated discharges from spills, leaks and unauthorized discharges. Comprehensive control of potential contamination sources are difficult to effect because these sources may not be associated with the primary purpose, product or output of institutions or enterprises. For example, the wastewaters produced by a school may be thought of as domestic in nature, but the addition of chemical and biological laboratories, automotive and shop classes may result in wastewaters that pose serious threats to the ground water.

Category D Land Uses

D.1. Institutional use, schools, colleges, hospitals, nursing homes, prisons

Mitigating Measures: These uses may require a DEP discharge permit for either ground water discharge or sewer connection. DEP staff and town agencies should integrate reviews to eliminate, or control through the use of Best Management Practices, potential sources of contamination. In drawdown and possibly recharge areas, periodic inspections by DEP, delegated municipalities, and water utilities could be performed. In these areas, underground fuel and chemical storage tanks could be banned. As stated in Category C, sewer exfiltration specifications could be consistent with those for construction in water supply watersheds, and stormwater controls should seek to maximize ground water recharge in drawdown areas.

D.2. High density housing (more than 1 dwelling unit per 1/2 acre)

Mitigating Measures: Use of septic systems not feasible, sewers needed, specifications for sewer construction - same as in D.1. Underground fuel storage, stormwater controls for streets and parking areas - same as in D.1. Periodic surveys and public education efforts should be required for water utilities and delegated municipalities.

D.3. Certain commercial uses. Conventional office buildings not including "professional" offices or retail activity. Banks, restaurants and other stable, domestic sewage limited uses may be in this category.

Mitigating Measures: Specifications for sewer construction same as above and should be considered preferable to on-site disposal in the approved drawdown area. Careful evaluation of on-site disposal systems per DEP standards, accompanied by pre-permit review for potential problems (print shops, photographic processing, floor drains, etc.). Restrictions on use could be recorded on the land records. Underground fuel and chemical storage, stormwater controls - same as above. Stepped-up education efforts and inspections by DEP, delegated municipal agents and water utilities.

**Category E: Land uses which pose a major threat to ground water, should be banned in drawdown areas and banned or strictly regulated in recharge areas**

These land uses pose major threats to ground water for a variety of complex reasons. Some dangers are obvious, such as uses which store, utilize and may discharge toxic, hazardous, or industrial materials. Other types of land uses have the potential of contamination from incidental but frequent utilization of substances of concern. Still other land uses pose a serious potential threat, since the use of a structure may change with little governmental oversite or control. A shopping center which can be considered "dry" can, virtually overnight entertain a new enterprize such as furniture stripping or photo processing with little control or oversight by any agency.

**Category E Land Uses** (Prohibit in drawdown areas, banned or strictly regulate in recharge areas)

E.1. Retail commercial development (discharges limited to domestic sewage)

Mitigating Measures: Sewers, stringent site reviews, inspections, and potential monitoring.

E.2. Commercial uses with chemical wastes in addition to domestic sewage as a result of the services offered

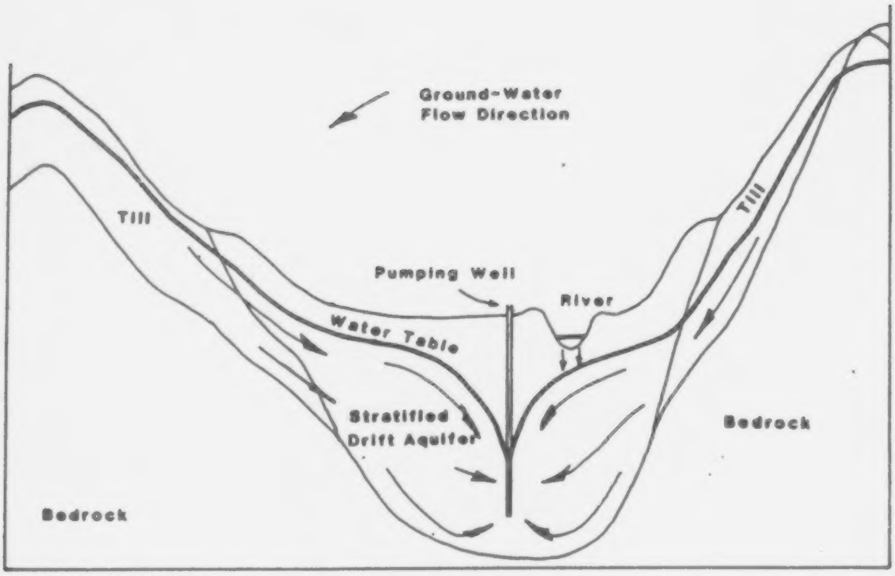
a) professional offices; medical, veterinary, etc.
b) commercial retail processors, furniture strippers, dry cleaners, photo processors, beauty shops, appliance repairs, etc.
c) auto body shops, service stations, machine shops, junkyards, etc.

Mitigating Measures: Existing uses, particularly E.2.b) and E.2.c) uses, could by State mandate, or municipal zoning be made non-conforming uses in approved drawdown areas. Municipalities could also, on a voluntarily basis, consider making such uses in recharge areas, non-conforming as well. Existing uses could be subject to stringent BMP's or performance standards, inspections, and potential monitoring requirements. The need for sanitary sewers for existing uses could be beneficial, but should be evaluated on a case-by-case basis.

E.3. Industrial uses, manufacturing, processing, research and storage facilities, all of which have the potential to cause contamination.

Mitigation Measures: Prohibit new uses in approved drawdown areas. Existing uses could, by State mandate, be made non-conforming uses in drawdown areas and subject to stringent BMP's or performance standards and potential monitoring. Municipalities could also consider making existing uses in approved recharge areas non-conforming as well. The need for sanitary sewers for existing uses in drawdown and recharge areas could be beneficial, but should be evaluated on a case-by-case basis. Stormwater controls for all Category E activities, should not be designed to achieve maximum ground water recharge.

# PROTECTION OF HIGH AND MODERATE YIELD STRATIFIED DRIFT AQUIFERS


Ground-Water
Flow Direction
Till
Till
Pumping Well
River
Water Table
Stratified
Drift Aquifer
Bedrock
Bedrock

Prepared
by the
Connecticut Department of Environmental Protection

Pursuant to Special Act 85-84

1987

## EXECUTIVE SUMMARY

This report, mandated by Special Act 85-84, addresses the identification and hydrogeologic components of Connecticut's high and moderate yield aquifers, and the critical need and potential methods for the protection of these aquifers which presently are or have the potential to provide significant quantities of public water supply in the future. **AS A RESULT OF THIS STUDY, IT IS CONCLUDED THAT THERE NOW REMAINS IN CONNECTICUT VERY LIMITED OPPORTUNITIES FOR NEW SOURCES OF HIGH YIELD GROUND WATER DEVELOPMENT: THAT EXTRAORDINARY MEASURES MUST BE TAKEN AS SOON AS POSSIBLE TO PROTECT THE QUALITY OF ALL EXISTING WATER SUPPLIES; AND TO ASSURE THE AVAILABILITY AS WELL AS PROTECT THE QUALITY OF THE FEW REMAINING SITES THAT CAN BE DEVELOPED FOR HIGH YIELD GROUND WATER SUPPLIES.**

The study and preparation of the report involved DEP's Water Compliance Unit, Natural Resources Center, and Planning and Coastal Area Management Unit, with contractual assistance performed by the Housatonic Valley Association (HVA) and the United States Geological Survey (USGS). The Water Supply Section of the Department of Health Services was also involved in the formulation of protection strategies and report organization. This study identified 38 potential high yield aquifers and an additional 120 moderate yield aquifers.

To protect these vulnerable hydrogeologic formations from potential sources of contamination, some new programs will be needed to supplement existing pollution control efforts. For program management purposes, two categories of these aquifers were identified for which new protection programs are recommended:

> **"high" yield aquifers** - those aquifer areas which may yield approximately 5 million gallons per day or greater without adversely affecting stream flow (see Figure 1); and
>
> **"moderate" yield aquifers** - those aquifer areas which may yield sufficient quantities of water to be an important resource as either local or regional public water supplements (see Figure 2)

Within all high and moderate yield aquifers there are existing public water supply wells or potential to site public wells. Critical components of aquifer systems requiring varying degrees of protection are **pumping wells, wellfields, drawdown areas, recharge areas and indirect recharge areas**. The basic protection strategies employed, depending on the critical aquifer component and existing land use conditions, should include: land acquisition, land use regulation to prevent the siting of threatening activities, and increased monitoring, inspections and regulation of particularly threatening land use activities. Recommended techniques could be used as follows:

1) Protection of "Wellfield Areas". Land surrounding a public water supply well (or wells) can be acquired for the purposes of controlling general access to the well(s), and providing a buffer to activities which may contaminate ground water immediately adjacent. Potential wellfields, probably in the range of 3 to 10 acres, should be identified, acquired and carefully managed to

prevent any activities which might contaminate them or otherwise prevent their future use.

2) Protection of "Drawdown Areas". Land under which the ground water has been lowered due to well pumping is referred to as the "drawdown area". Ground water in drawdown areas may flow more rapidly to a wellfield due to effects of gravity and hydraulic gradient. Drawdown areas for high and moderate yield aquifers are likely to range in size from 20 to 100 acres. Although acquisition would best guarantee protection, it is not likely to be econmically feasible nor pratical due to the large land area involved, and therefore some partial acquisition, where appropriate, and strict regulation of both future and existing uses must be considered. Existing uses located in "drawdown areas" should be carefully reviewed to determine whether additional controls need to be implemented. Future land uses having a high risk of contamination should be prevented from siting in the drawdown areas.

3) Protection of "recharge areas". Land upgradient of the wellfield that replenishes the drawdown area by ground water flow is referred to as the "recharge area". Similar to drawdown areas, both existing and future land uses in recharge areas should be reviewed and subject to new, but possibly less stringent controls than those that may be developed for the drawdown areas.

4) Protection of "indirect recharge areas". Land upgradient of the wellfield that replenishes the recharge or drawdown areas through natural or induced infiltration from surface water flow over the aquifer (i.e. the remainder of the drainage basin that supplies water to the watercourse that flow over the aquifer). Water quality protection of the indirect recharge areas is largely attained through State surface and ground water protection strategies, however, voluntary municipal land use controls and individual best managment practices will afford additional protection to these areas.

There are a number of ways to approach the design of management programs to provide greater protection of these special aquifer areas. The report discusses the role of State and local government in protecting these areas and recommends short and long terms actions to define the best program for Connecticut. Short term recommendations are:

o ESTABLISH A TASK FORCE TO BRING THIS PROGRAM TO OPEN DEBATE AND CONSENSUS ON AQUIFER PROTECTION IMPLEMENTATION, DEFINE THE COSTS OF IMPLEMENTATION AND DEVELOP ANY NEEDED LEGISLATION;

o PROVIDE INCENTIVES FOR THE DEVELOPMENT OF DEMONSTRATION AQUIFER PROTECTION PROJECT(S) USING THE MANAGMENENT AREAS AND TECHNIQUES DESCRIBED IN THE REPORT;

o PROVIDE THE RESOURCES NEEDED TO CONTINUE THE HYDROGEOLOGIC DATA COLLECTION, MODELING, AND AQUIFER PROTECTION COMPONENT AREA DELINEATION OF THE REMAINING HIGH YIELD AQUIFER STUDY AREAS; AND

o SUPPORT THE AMENDMENT OF THE STATE PUBLIC HEALTH CODE TO INCREASE THE AREA OF SANITARY PROTECTION AROUND THE PUBLIC WATER SUPPLY WELLS.

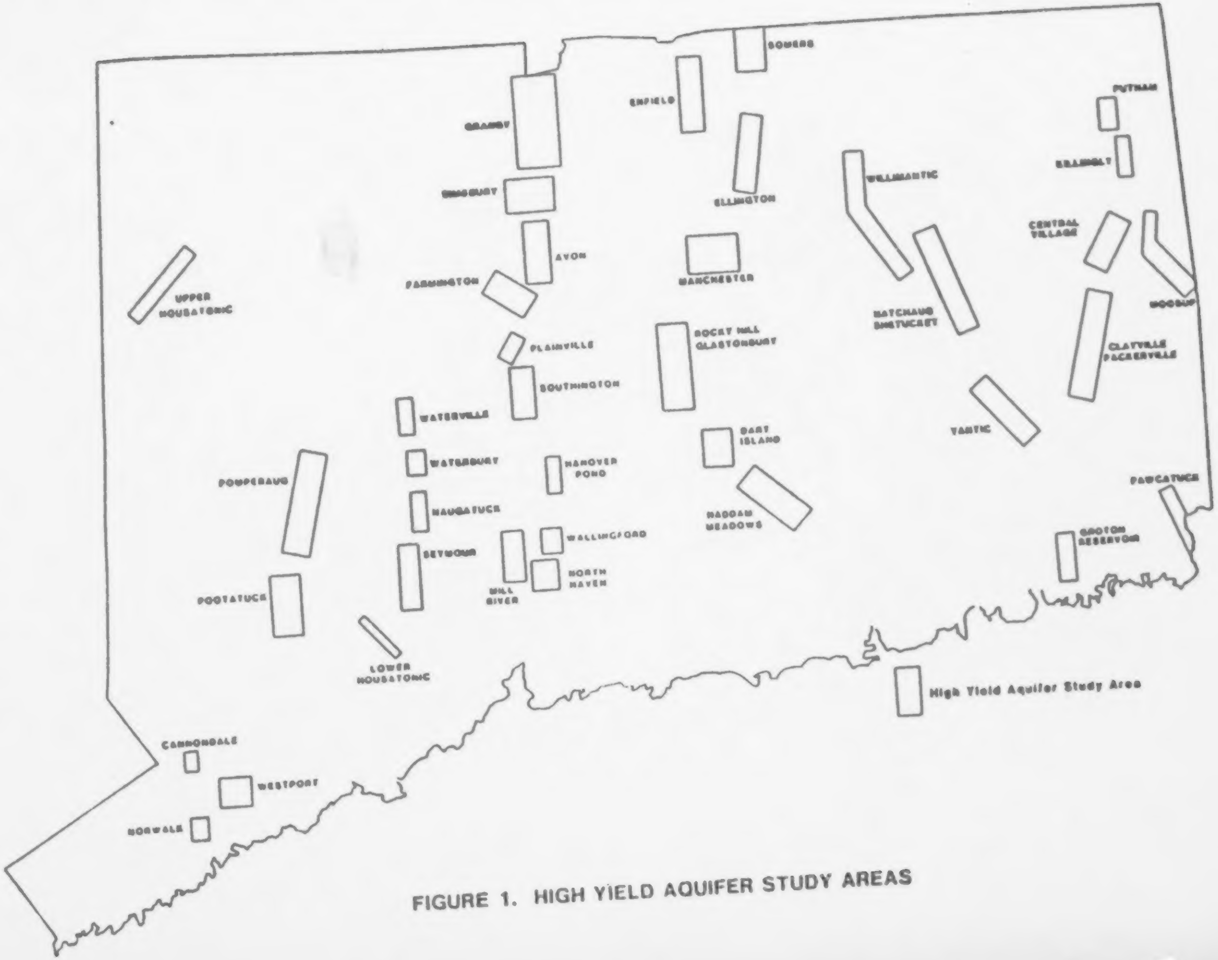

SOMERS
ENFIELD
GRANBY
SIMSBURY
AVON
FARMINGTON
UPPER HOUSATONIC
ELLINGTON
MANCHESTER
WILLIMANTIC
NATCHAUG SHETUCKET
PUTNAM
CENTRAL VILLAGE
MOOSUP
CLAYVILLE PACKERVILLE
YANTIC
PAWCATUCK
GROTON RESERVOIR
ROCKY HILL GLASTONBURY
PLAINVILLE
SOUTHINGTON
WATERVILLE
WATERBURY
NAUGATUCK
SEYMOUR
HANOVER POND
WALLINGFORD
NORTH HAVEN
MILL RIVER
DART ISLAND
HADDAM MEADOWS
POMPERAUG
POOTATUCK
LOWER HOUSATONIC
CANNONDALE
WESTPORT
NORWALK
High Yield Aquifer Study Area

FIGURE 1. HIGH YIELD AQUIFER STUDY AREAS

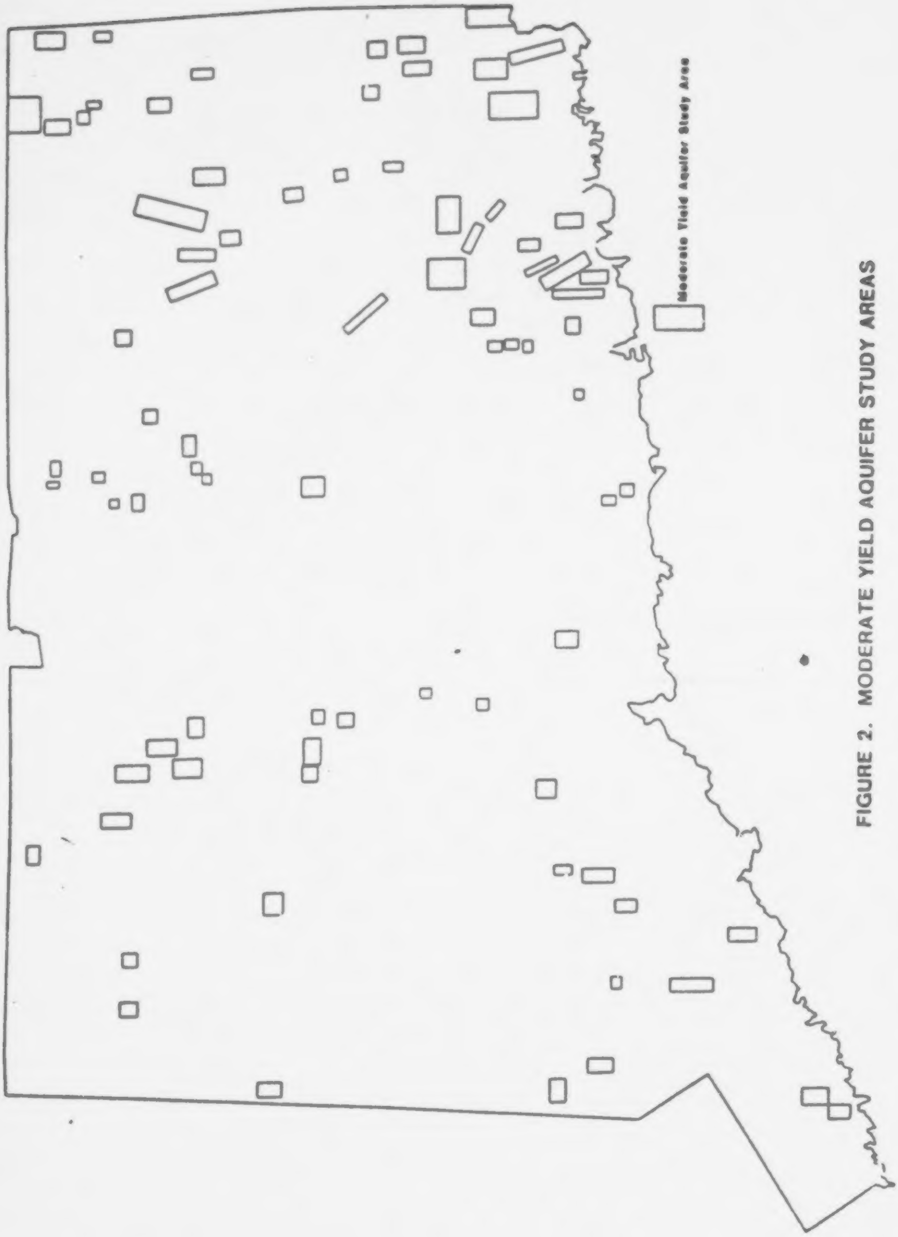

Moderate Yield Aquifer Study Area

FIGURE 2. MODERATE YIELD AQUIFER STUDY AREAS

## PREFACE

The Water Resources Task Force, established by Special Act 82-28, recommended that the Department of Environmental Protection (DEP) be directed by statute to prepare a report to the legislature, on or before January 15, 1987, regarding improved protection of public ground water supply resources and options for improved protection of "regionally significant aquifers". An Act to this effect was passed in 1985 when the General Assembly passed Special Act 85-84.

Special Act 85-84 charged DEP to prepare a report consisting of a map of areas requiring protection and a management strategy to protect such areas. This report and companion maps are DEP's response to Special Act 85-84. The management strategy focuses on improved protection of "high" and "moderate" yield stratified drift aquifers.

Preparation of this report involved DEP's Water Compliance Unit, Natural Resources Center and Planning & Coastal Area Management Unit. The Department of Health Services, Water Supply Section also participated in formulating the strategy. To accomplish this project, contractual assistance was necessary and the Housatonic Valley Association (HVA) was hired to: 1. map DEP designated, 38 potential high yield aquifers and associated land use and zoning information; 2. to research various management techniques potentially applicable to the protection of regional and local aquifers; and 3. make management recommendations to the Department. A cooperative program was also established with the United States Geological survey.

During the development of the strategy, DEP eliminated the use of the term "regionally significant aquifer" used in Special Act 85-84 and also in HVA's reports. This change was made because DEP's strategy for protecting regionally significant aquifers and local aquifers are very similar, the only substantial difference being a matter of establishing management priorities (i.e. greater efforts be made to implement programs initially to protect the larger ground water resources).

We thank HVA, especially Ralph Goodno, Elaine Luckey, Lynn Werner, Paul Sabrosky, Randy Lemon and Chris Kotrotsios, for fulfilling difficult contract requirements successfully. DEP's strategy is generally consistent with HVA's recommendations except that protection areas are more distinctly identified, and more emphasis is given to the possibility of expanding DEP monitoring, inspection and enforcement programs. HVA's reports entitled, "Study and Recommendations for Regional and Local Aquifer Protection" and "Recommendations for a Regional Aquifer Protection Program" were used by DEP in formulating this report, and will be forwarded to the Legislature's Environment Committee for background information.

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## APPENDICES

A. Terminology used in Table 1 to describe status of hydrogeologic studies of high yield aquifers

## REFERENCE DOCUMENTS (unattached)

A. "Summary Assessments of High Yield Aquifers", DEP -Water Compliance Unit
B. "Hierarchy of Land Uses Over High and Moderate Yield Aquifers", DEP - Water Compliance Unit
C. "Study and Recommendations for Regional and Local Aquifer Protection Programs", prepared by the Housatonic Valley Association
D. "Housatonic Valley Association Recommendations for a Regionally Significant Aquifer Protection Program"
E. Map, "Groundwater Yields for Selected Stratified Drift Areas in Connecticut", dated 1986, prepared by a USGS Cooperative Program with DEP
F. Map, "Community Water Systems in Connecticut, A 1984 Inventory", prepared by DEP's Natural Resources Center.

## Chapter I - Introduction

### CONNECTICUT'S STATEWIDE GROUND WATER MANAGEMENT STRATEGY

Connecticut has two types of aquifers, unconsolidated sand and gravel deposits of glacial origin (stratified drift aquifers), and consolidated bedrock. Stratified drift aquifers, although unevenly distributed within the State, are the most productive. They are the primary source of ground water withdrawals for public supply and large commercial and industrial uses. Bedrock aquifers underlie the entire State and with substantial lower well yields, are the principal source of water tapped by private wells to serve individual homes.

Although State regulatory requirements for wastewater and leachate discharges, hazardous wastes, bans on certain hazardous substances, and other ground water protection mechanisms are more comprehensive than ever, increasing population and urbanization suggests Connecticut may continue to experience ground water contamination. Stratified drift aquifers are very susceptible to contamination and public water supply wells tapping these resources may be adversely affected in the future unless the State's nonpoint source pollution control program expands into a preventative mode involving land use decisions and more stringent inspection and monitoring of existing facilities that are, at present, unregulated potential sources of ground water contamination.

### WHAT IS THE STATE DOING NOW

Over the years, Connecticut has established a number of programs to protect and manage its ground water resources and to ameliorate the impacts of ground water contamination. These management programs apply statewide and fall into the following categories:

1. Drinking Water Standards.
2. Water Quality Standards and Classifications.
3. Source Controls.
4. Enforcement.
5. Statewide Bans.
6. Best Management Practices.
7. Victim Compensation.
8. Planning.
9. Water Use and Allocation.
10. Monitoring.
11. Research.
12. Data Management.
13. Local Assistance.
14. Education.

Detailed descriptions of these programs can be found in a companion document entitled, "A Ground Water Management Strategy for the State of Connecticut", January 1987.

## POSSIBLE ADDITIONS TO STATE MANAGEMENT PROGRAMS

Clearly, the State has taken major efforts to identify contamination concerns and effect clean-up and prevention activities for a multitude of potential contamination sources. Nevertheless, some additional programs related to land uses are needed to fulfill the State's comprehensive ground water strategy. The specific geologic formations targetted for additional protection are those which have significant potential for supplying large quantities of ground water and which are highly vulnerable to contamination. For management purposes, two categories of stratified drift aquifers can be identified for which new protection programs are recommended.

> **"high" yield aquifers**, those aquifer areas which on the basis of preliminary investigations, may yield approximately 5 million gallons per day or greater without adversely affecting stream flow (see Figure 1.); and
>
> **"moderate" yield aquifers**, those aquifer areas which may yield sufficient quantities of water to be an important resource as either local or regional public water supplements (see Figure 2.).

On the basis of studies conducted pursuant to Special Act 85-84 and experiences with ground water contamination problems, DEP has concluded additions to Connecticut's ground water management program need to include:

1. Protection of potential high and moderate yield wellfields for public water supply;
2. Strict regulation of activities in drawdown areas immediately adjacent to potential high and moderate yield wellfields where potential contamination sources would be most threatening;
3. Management of activities in recharge areas of high and moderate yield aquifers; and
4. State surface and ground water protection strategies in indirect recharge areas.

Refer to Figures 3., 4. and 5., schematics prepared to depict these four different areas in relationship to the larger ground water resource.

New Program Implementation:

Implementation of new programs to protect wellfields, drawdown and recharge areas could include the use of three primary techniques: **land acquisition, land use regulation to prevent the siting of threatening activities, and increased monitoring and regulation of particularly threatening land use activities, such as commercial and industrial development.** In broad outline, these techniques could be used in the following fashion:

Protection of "Wellfield Areas". Lands surrounding a public water supply well (or group of public water supply wells) can be acquired for the purposes of controlling general access to the well(s); and providing a buffer to activities which may contaminate ground water immediately adjacent. Potential wellfields, probably in the range of 3 to 10 acres, should be identified, acquired and carefully managed to prevent any activities which might contaminate them or otherwise prevent their future use. Until developed for water supply, these sites may offer recreational opportunities for open space,

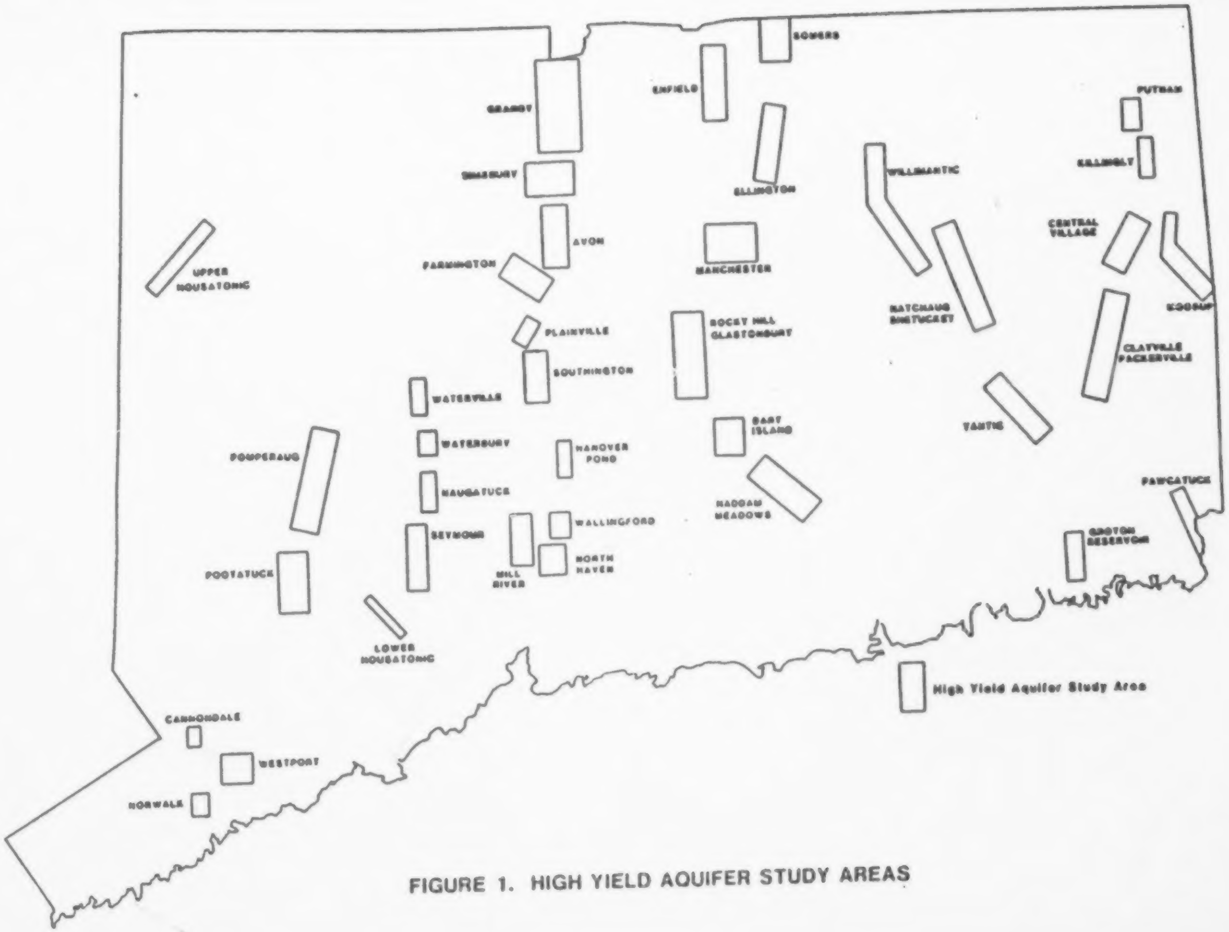

SOMERS
ENFIELD
GRANBY
SIMSBURY
ELLINGTON
PUTNAM
KILLINGLY
WILLIMANTIC
AVON
FARMINGTON
UPPER HOUSATONIC
MANCHESTER
CENTRAL VILLAGE
MOOSUP
NATCHAUG SHETUCKET
PLAINVILLE
ROCKY HILL GLASTONBURY
CLAYVILLE PACKERVILLE
SOUTHINGTON
WATERVILLE
EAST ISLAND
YANTIC
POMPERAUG
WATERBURY
HANOVER POND
NAUGATUCK
HADDAM MEADOWS
PAWCATUCK
WALLINGFORD
SEYMOUR
GROTON RESERVOIR
NORTH HAVEN
MILL RIVER
POOTATUCK
LOWER HOUSATONIC
High Yield Aquifer Study Area
CANNONDALE
WESTPORT
NORWALK

FIGURE 1. HIGH YIELD AQUIFER STUDY AREAS

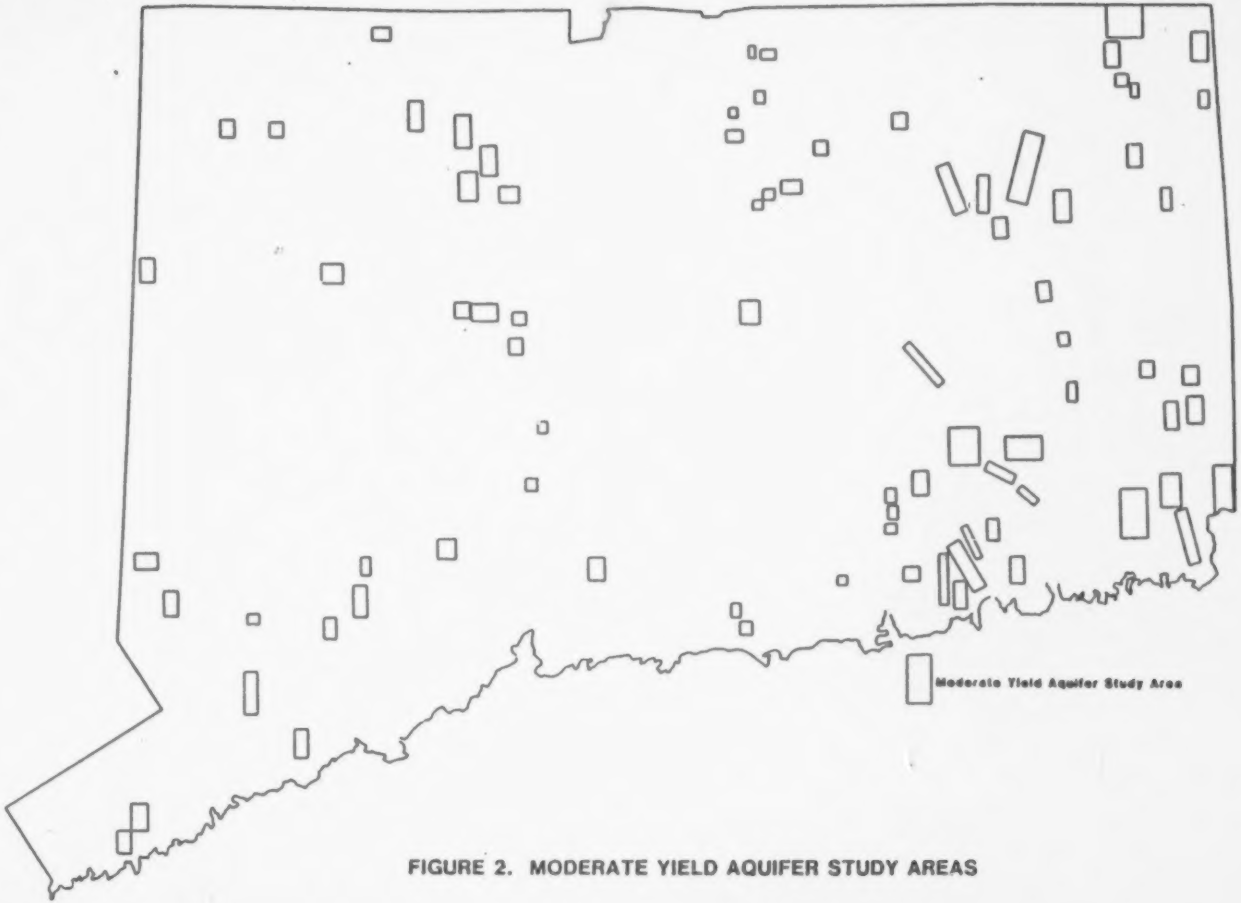

Moderate Yield Aquifer Study Area

FIGURE 2. MODERATE YIELD AQUIFER STUDY AREAS

playing fields and passive recreation. Similar to recent experiences in Connecticut regarding the loss of potential reservoir sites, potential wellfields can be lost simply because the land has, or will be developed, physically leaving no room left for an adequately protected wellfield. Existing wellfield sites may also benefit from additional land purchase.

Protection of "Drawdown Areas". Land under which the ground water have been lowered due to well pumping is referred to as the "drawdown area" (see Figures 3 and 4 which shows ground water flow patterns under natural conditions and under pumping conditions). Ground water in drawdown areas may flow more rapidly to a wellfield due to effects of gravity and hydraulic gradient. Drawdown areas for high and moderate yield aquifers are likely to range in size from 20 to 100 acres. These areas are highly susceptible to contamination and therefore are in need of stringent protection.

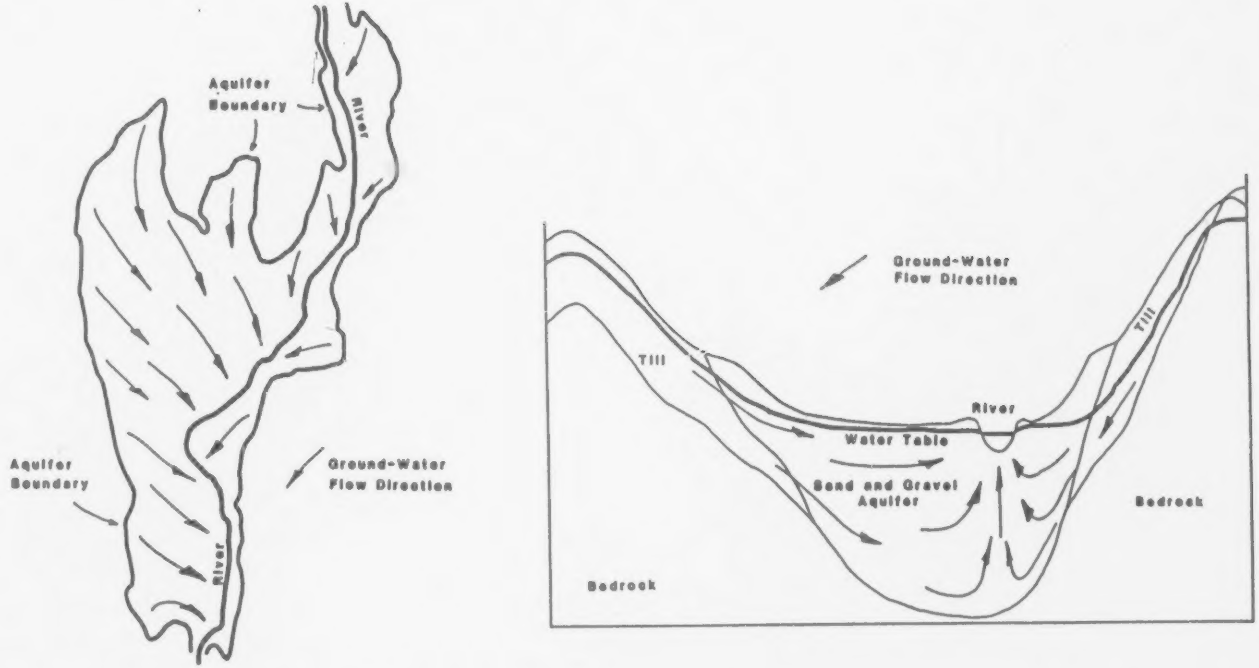
Acquisition, although it would best guarantee protection, it is not likely to be economically feasible due to the large area involved, and therefore some partial acquisition, where appropriate, and strict regulation of both future and existing land uses must be considered.

Existing uses located in "drawdown areas" could be carefully reviewed to determine whether additional controls need to be implemented. Special techniques for phasing out existing threatening uses to reduce long term contamination risks should be considered.

Future uses located in "drawdown areas" having a moderate or high risk of contamination should be prevented from siting in the drawdown area. DEP has prepared a report entitled, "Hierarchy of Land Uses Over High and Moderate Yield Aquifers" which describes the compatibility of various land uses with the geologic formations important to supply of public drinking waters. This "Land Use Hierarchy", pending further review and development, could provide the basis for municipally applied, State standards for reviewing both new and existing land uses in "drawdown areas".

Protection of "Recharge Areas". Land upgradient of the wellfield that replenishes the drawdown area by ground water flow is refered to as the "recharge area". Similar to drawdown areas, both existing and future land uses in recharge areas can be reviewed and subject to new, but possibly less stringent controls than those that may be developed for "drawdown areas". Again, DEP's "Land Use Hierarchy" can serve as a guide to those uses which are generally compatible in recharge areas. Due to the extent of land potentially directly recharging a wellfield, no area dimensions are offered at this time. Various approaches to establishing recharge areas is the the focus of additional discussions in later Chapters.

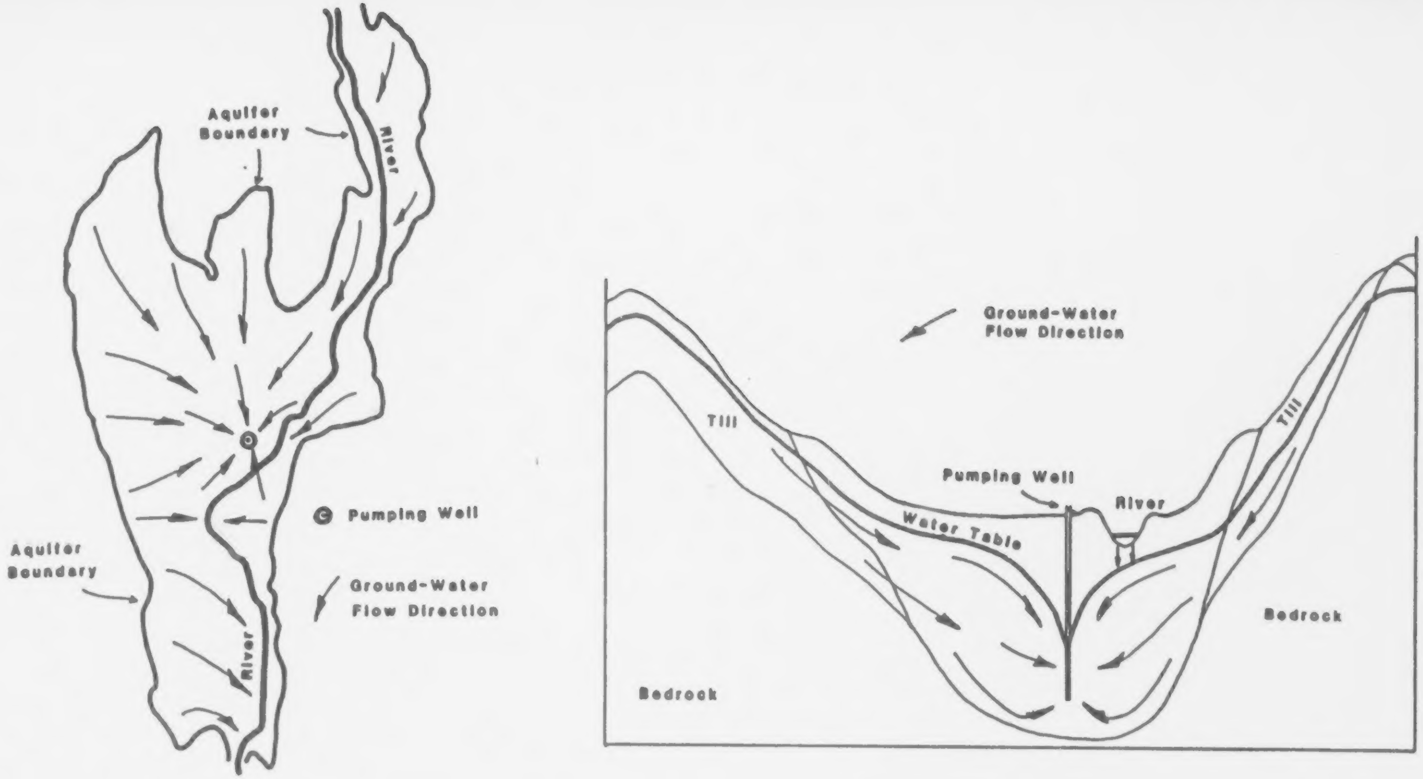
Protection of "Indirect Recharge Areas". Land upgradient of the wellfield that replenishes the recharge or drawdown areas through natural or induced infiltration from surface water flow over the aquifer (i.e. the remainder of the drainage basin that supplies water to the watercourse that flow over the aquifer). Water quality protection of the indirect recharge areas is largely attained through State surface and ground water protection strategies, however, voluntary municipal land use controls and indivigual best managment practices will afford additional protection to these areas.


Aquifer Boundary
River
Aquifer Boundary
Ground-Water Flow Direction
River
Ground-Water Flow Direction
Till
River
Water Table
Sand and Gravel Aquifer
Till
Bedrock
Bedrock

A. Areal View

B. Cross-sectional View

FIGURE 3. WATER TABLE PROFILE - NONPUMPING


Aquifer Boundary
River
Aquifer Boundary
Pumping Well
Ground-Water Flow Direction
River
Ground-Water Flow Direction
Till
Pumping Well
River
Water Table
Till
Bedrock
Bedrock

A. Areal View

B. Cross-sectional View

FIGURE 4. WATER TABLE PROFILE - PUMPING

See Figure 5. to view these potentially different areas of protection within and contiguous to the actual stratified drift resource.

## Roles and Responsibilities for Administering Protection Area Programs

Implementation of these programs will require a high degree of coordination amongst State and municipal government agencies. State control and coordination will be required to a greater degree than in many other resource protection and land use control programs. Establishing minimum standards, and performing many of the monitoring, inspection, enforcement and overall program overview functions should be considered by the State.

Municipal government, through its planning and zoning functions, health director responsibilities, delegated authorities from DEP and other mechanisms, will need to be educated with respect to these protection areas and protection mechanisms and carry out major program responsibilities. Guidance, direction, technical and possibly financial assistance from the State will be necessary to foster an understanding of the resource protection areas and needs such that development of municipal programs are consistent with State objectives and will complement other activities likely to be carried out by the State. Difficult management problems are posed by the protection areas since they cross municipal boundaries, and therefore municipalities will be faced with the need to protect areas important for the water supply of other municipalities. How little it takes to cause contamination and that sources of potential contamination are not necessarily easily identifiable, adds to program complexities.

The Federal Congress and Environmental Protection Agency (EPA) are becoming increasingly interested in assisting States in developing new ground water protection programs. Specifically, the 1986 amendments of the Federal Safe Drinking Water Act includes a Section authorizing EPA to give grants to States for purposes of developing "Wellhead Protection Programs". DEP has been working with several EPA committees charged with developing Wellhead Protection Program guidelines to ensure compatability of forthcoming Federal program assistance with the State of Connecticut's legislative and State agency interests to provide a greater level of protection for these special areas surrounding Connecticut's public water supply wells.

Chapter II of this report reviews study methods employed by DEP and its contractor to date, and summarizes the extent of available information regarding high and moderate yield aquifers including information on preliminary resource mapping, potential contaminations threats including land use and zoning, general water quality and water use information, and hydrogeologic data and analysis needs.

Chapter III presents a variety of techniques which can be used to protect wellfields, drawdown areas and recharge areas. Costs for implementing these possible protection mechanims can begin to be developed through a public and legislative review process. Given the myriad of possible approaches which can be employed, such cost estimates are beyond the capabilities of this project at this time. Chapter IV offers short term suggestions regarding how Connecticut's high and moderate yield aquifer protection program could be further developed during 1987 and beyond.

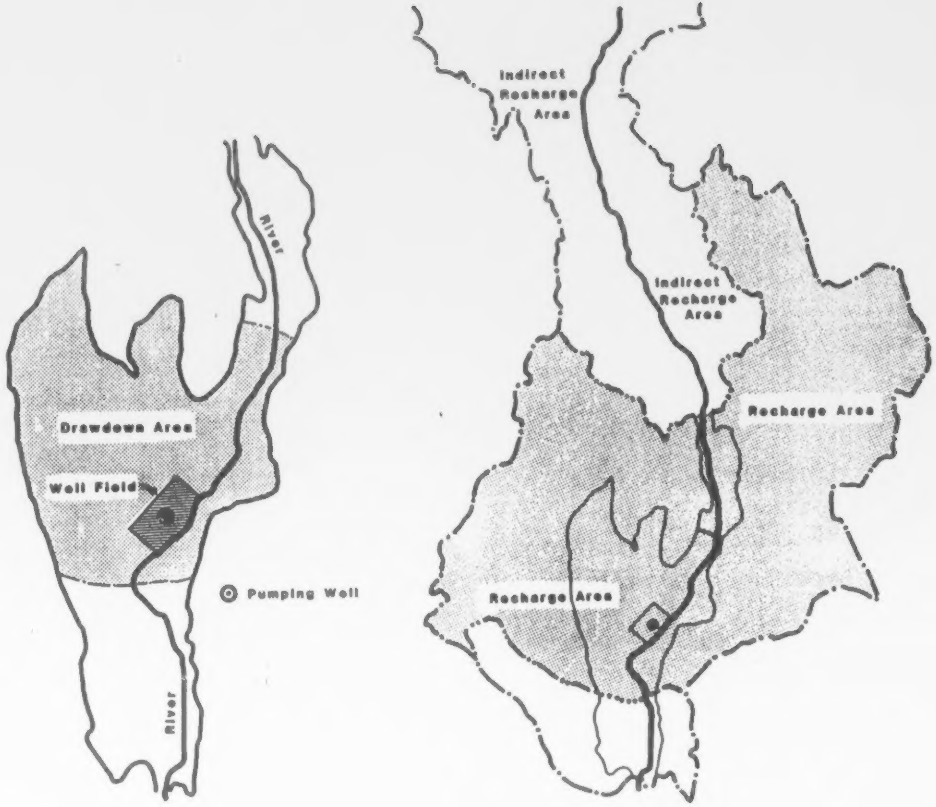

River
Drawdown Area
Well Field
River
Pumping Well
Indirect Recharge Area
Indirect Recharge Area
Recharge Area
Recharge Area

FIGURE 5. PROTECTION AREA DELINEATIONS

## Chapter II - Study Methods

This Chapter summarizes DEP efforts to gather hydrogeologic data, report additional hydrogeologic data needs, develop computer models of ground water resources, delineate aquifer protection areas and preliminarily assess potential water quality problems and land use conflicts in and over identified high yield aquifer resources. Similar techniques can be applied to moderate yield aquifers, but such resource assessments were beyond the scope of this study. Priorities for additional data collection, modeling analyses and program implementation for both high and moderate yield aquifers, however, can develop from the summary of these activites.

Actual hydrogeologic data collection for high and moderate yield coarse grained stratified drift aquifers began many years ago. More recently though, through cooperative programs with the U.S. Geological Survey, several key ground water projects brought Connecticut to a level of information and understanding of these major ground water resources whereby the need for expanded State authorities could be assessed in a comprehensive manner. These projects were:

o - the publication in 1978 of a statewide map entitled "Ground-water Availability in Connecticut", by Meade (DEP). This map presented a summary of all hydrogeologic conditions and general ranges of ground-water availability in various of surface materials and bedrock;

o - since 1978, hydrogeologic data collection (geophysical, test drilling, field surveys, and laboratory analyses) were conducted throughout the State and resulted in the development of computerized analytical (specific site conditions) and digital (total aquifer conditions) aquifer models for Connecticut conditions;

o - the publication in 1986 of "Community Water Systems in Connecticut, A 1984 Inventory". This map is a compilation of all public water supply systems including the location of existing public water supply wells; and

o - publication in 1986 (to be available from the printers in 1987) of "Estimates of Long-term Ground-water yields and Low Streamflow for Selected Stratified Drift Areas in Connecticut". A synthesis of information for high and moderate yield coarse grained stratified drift aquifers indicating the potential yield of an aquifer area and the low flow conditions of the stream over the aquifer.

### Preliminary Mapping

Existing information was used by DEP's contractor, the Housatonic Valley Association (HVA), to prepare general high yield aquifer resource maps that shows the extent of the resource, and tributary areas which either recharge the entire aquifer by ground water or surface water recharge. Mapping techniques used were similar to those described in "Delineating Recharge Areas for Stratified Drift Aquifers in Connecticut with Geologic and Topographical Maps", a USGS publication prepared by Elinor H. Handman (Water Resources Investigations Report # 83-4230). Similar mapping of moderate yield aquifer systems was not accomplished. The HVA also prepared overlays of present land use (information not available for all towns) and zoning to facilitate DEP's preliminary assessment of potential water quality concerns (discussed later in this Chapter).

## Hydrogeologic Investigations and Computer Simulations

Concurrently with the HVA general mapping project, DEP - Natural Resources Center compiled all hydrogeologic data for the 38 candidate high yield aquifers for the initial purpose of identifying where additional data gathering should occur to better define hydrogeological conditions.

Hydrogeologic investigations are necessary to refine our understanding of the physical characteristics of the resource, such as confirming its capability to provide large quantities of water, and to provide improved data for computer modeling. Simulation modeling is needed to help determine potential wellfield sites, drawdown and recharge areas. Computer modeling can be used to simulate drawdown areas under different pumping scenarios than the existing withdrawal rates. In relation to the categories of areas to be protected, hydrogeological investigations can entail the following.

Wellfields - Test borings and seismic profiles are needed to confirm the nature and depth of the stratified drift deposits, and pump testing to verify potential yield. The high and moderate yield aquifers each have unique characteristics and differing levels of available hydrogeological information. At the present time, very few aquifers have sufficient data to locate, with a high degree of confidence, future wellfield sites.

Drawdown Areas - Actual pump testing (using either existing wells or test boring wells installed for identifying potential wellfield sites), water level monitoring and computer simulations will be required to determine the land under which ground water will be lowered. The extent of lowering or where one delineates the drawdown boundary (i.e. lowered 1 foot, 0.1 foot or other amount) continues to be evaluated. Hydrogeological studies should also be detailed enough to allow assessment of stream flow recharge. For example, computer simulations should reflect drawdown conditions that will maintain stream flow sufficient to maintain aquatic habitat, aquatic life and other uses of the adjacent surface water resource.

Recharge Areas - These areas can be more expansive than drawdown areas and consideration should be given to placing a practical area limit based on either distance from the wellfield or time-of-travel to the wellfield to limit this area of protection to a reasonable amount. For example, if a recharge area extends more than two miles away from the wellfield (contamination plume studies done nationally conclude the large majority of plume lengths is less than 2 miles), or if ground water takes 5 to 10 years or more to reach the drawdown area, more stringent land use regulations may not be appropriate. Additional monitoring could be required however, and if contamination does occur, and theorectically cleanup actions take place prior to a plume reaching the drawdown area.

Assuming wellfields and drawdown areas are identified by the techniques described above, `recharge areas can be mapped using available information that has been improved with hydrogeological data to verify direction and rate of ground water flow. Due to present uncertainties regarding recharge area determinations, no estimates are available to put into perspective the extent of associated recharge area size. The Federal EPA is presently preparing technical guidelines (to be available in June, 1987) to help State's, as a practical matter, decide on a process for determining how large such areas need be for special area protection. DEP is presently working with EPA's Wellhead Protection Program "Technical" and "Management" Committees in order to gather additional information regarding different techniques to determine protection area limits and to manage these areas. Much of the Connecticut aquifer protection program will be used in the national guidance for implementing the Safe Drinking Water Act, Wellhead Protection Program.

Table 1 presents information regarding the status of hydrogeological assessments of all identified high yield aquifers with respect to gathering hydrogeological data, performing computer modeling and tentatively determining areas of protection. It is important to note that only one high yield aquifer has completed studies using this process, the Canondale Aquifer in Wilton. The remaining 37 high yield aquifers are in various levels of assessment.

### Land Use and Zoning Assessment

Using the HVA prepared map overlays, DEP summarized existing land use and zoning information for the high yield aquifer candidates. These relatively simple summaries were used to assess potential contamination problems, give insight on possible protection strategies and help identify priorities for additional hydrogeological studies described above.

### Pollution Source and Water Quality Classification Assessment

Using DEP maps of potential pollution sources and adopted Water Quality Classifications, DEP summarized other sources of potential water quality threats for the high yield aquifer candidates. Similar to the land use and zoning assessments, this information was used to give insight on possible protection strategies and help identify priorities for additional hydrogeological studies described above.

These assessments are included for individual high yield aquifers in a reference document entitled, "Summary Assessments of High Yield Aquifers", prepared by DEP's Water Compliance Unit. The information contained in these assessments was used to prepare the following high yield aquifer "Integrity Ranking System". This system can be used to guide future expenditures of State resources in furthering identification of future wellfields, drawdown and recharge areas.

| AQUIFER NUMBER | AQUIFER NAME | PRELIMINARY INFORMATION<br>PRELIM YIELD LOW | PRELIM YIELD HIGH | MODEL TYPE | STREAM LOW FLOW | AQUIFER CLASS | WATER USE | HYDRO GEOLOGIC ELEMENTS<br>BASIC DATA INVENTORY | GEOPHYS | BORING | QUALITY | SATURATED THICKNESS | HYDRAULIC CONDUCTIVITY | TRANSMISSIVITY | STREAM-AQUIFER CONNECTION | POT.WELL FIELDS | MODELLING<br>NONPUMPING MODEL | CALIBRATION | WELL SITES SELECTED | PUMPING MODEL | PUMP TEST |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | UPPER HOUSATONIC | 6.0 | 10.1 | ANALYTICAL | 170.0 | I | UD | C | N | C | N | C | P | P | N | P | N | N | N | N | N |
| 2 | LOWER HOUSATONIC | 22.6 | 26.2 | ANALYTICAL | 324.0 | II | PD | P | U | P | P | P | P | P | N | P | N | N | N | N | N |
| 3 | POMPERAUG | 5.0 | 8.8 | DIGITAL | 2.7 | II | UD | C | U | U | P | C | C | C | C | C | C | C | C | C | N |
| 4 | POOTATUCK | | - 4.0 | DIGITAL | 2.3 | II | PD | C | U | U | P | C | C | C | C | C | C | C | C | C | N |
| 5 | NORWALK | 4.9 | 6.1 | ANALYTICAL | 4.8 | II | UD | C | U | U | P | C | C | C | N | C | N | N | N | N | N |
| 6 | CANNONDALE | 3.0 | 4.6 | DIGITAL | 2.3 | II | UD | C | U | U | P | C | C | C | C | C | C | C | C | C | C |
| 7 | WESTPORT | 6.7 | 7.4 | ANALYTICAL | 3.1 | I | FD | P | U | U | P | C | C | C | N | C | N | N | C | N | C |
| 8* | WATERVILLE | 8.7 | 9.4 | ANALYTICAL | 21.0 | III | UD | C | N | U* | U* | P* | N* | C* | N* | N* | N* | N* | N* | N* | N* |
| 9* | WATERBURY | 4.8 | 6.0 | ANALYTICAL | 32.0 | III | UD | C | U | U* | U* | P* | N* | C* | N* | N* | N* | N* | N* | N* | N* |
| 10* | NAUGATUCK | 10.2 | 11.8 | ANALYTICAL | 63.0 | III | UD | C | U | U* | U* | P* | N* | C* | N* | N* | N* | N* | N* | N* | N* |
| 11* | SEYMOUR | 7.4 | 10.6 | ANALYTICAL | 69.0 | III | UD | C | U | U* | U* | P* | N* | C* | N* | N* | N* | N* | N* | N* | N* |
| 12 | MILL RIVER | 9.9 | 11.0 | ANALYTICAL | 7.0 | II | FD | C | U | U | C | C | P | C | N | C | N | N | N | N | N |
| 13 | GRANBY | | - 26.2 | ANALYTICAL | | II | UD | C | C | U | P | C | P | P | N | N | N | N | N | N | N |
| 14 | SIMSBURY | | - 18.5 | ANALYTICAL | 150.0 | II | PD | C | C | U | P | C | C | P | N | N | N | N | N | N | N |
| 15 | AVON | | - 7.5 | ANALYTICAL | 145.0 | II | UD | C | C | U | P | C | P | P | N | N | N | N | N | N | N |
| 16 | FARMINGTON | | - 5.7 | DIGITAL | 130.0 | II | PD | C | C | U | P | C | C | C | C | C | C | N | N | N | N |
| 17 | PLAINVILLE | | - 8.1 | ANALYTICAL | 15.0 | II* | UD | C | C | U | P | C | P | C | N | N | N | N | N | N | N |
| 18 | SOUTHINGTON | 8.0 | 10.1 | ANALYTICAL | 6.0 | II* | FD | C | P | U | P | C | P | C | N | N | N | N | N | N | N |
| 19 | HANOVER POND | 6.0 | 8.9 | ANALYTICAL | 34.0 | II* | PD | C | P | U | P | C | P | P | N | N | N | N | N | N | N |
| 20 | WALLINGFORD | 11.4 | 16.1 | ANALYTICAL | 37.0 | II* | PD | C | N | U | P | P | P | P | N | N | N | N | N | N | N |
| 21* | NORTH HAVEN | 10.2 | 13.1 | ANALYTICAL | 40.0 | III | UD | C | U | U* | U* | P* | P* | P* | N* | N* | N* | N* | P* | N* | P* |
| 22 | ENFIELD | | - 5.1 | ANALYTICAL | 13.5 | II* | PD | C | P | N | P | C | P | C | N | N | N | N | N | N | N |
| 23 | SOMERS | | - 5.8 | ANALYTICAL | 6.0 | II | PD | C | P | N | P | C | P | C | N | N | N | N | N | N | N |
| 24 | ELLINGTON | | - 7.4 | ANALYTICAL | 5.0 | II* | PD | C | P | U | P | C | P | C | N | N | N | N | N | N | N |
| 25 | MANCHESTER | | - 7.2 | ANALYTICAL | 16.5 | II | FD | C | C | U | P | P | P | C | N | N | N | N | P | N | P |
| 26 | ROCKY HILL GLASTONBURY | | - 19.8 | ANALYTICAL | 2750.0 | II | UD | C | C | P | P | P | P | P | N | P | N | N | N | N | N |
| 27 | DART ISLAND | | - 5.2 | ANALYTICAL | 2800.0 | II | UD | C | C | U | P | C | C | C | N | C | N | N | N | N | N |
| 28 | HADDAM MEADOWS | | - 8.8 | ANALYTICAL | 2900.0 | I | UD | C | C | C | P | C | C | C | N | C | N | N | N | N | N |
| 29 | WILLIMANTIC | | - 10.1 | ANALYTICAL | 22.0 | I | PD | P | C | C | N | C | P | P | N | P | N | N | P | N | P |
| 30 | NATCHAUG-SHETUCKET | | - 10.9 | DIGITAL | 64.0 | II | UD | P | P | U | N | C | C | C | C | C | C | N | N | N | N |
| 31 | YANTIC | | - 4.9 | ANALYTICAL | 12.0 | I | UD | P | U | N | N | C | P | P | N | N | N | N | N | N | N |
| 32 | PUTNAM | | - 11.3 | ANALYTICAL | 60.0 | II | PD | C | C | U | P | C | P | P | N | C | N | N | P | N | P |
| 33 | KILLINGLY | | - 4.9 | ANALYTICAL | 21.0 | II | PD | C | C | U | P | C | P | P | N | C | N | N | P | N | P |
| 34 | CENTRAL VILLAGE | | - 5.8 | ANALYTICAL | 127.0 | II | FD | P | C | U | P | C | P | P | N | C | N | N | P | N | P |
| 35 | CLAYVILLE-PACKERVILLE | 7.5 | 8.7 | ANALYTICAL | 153.0 | II | PD | P | N | N | N | P | N | P | N | N | N | N | N | N | N |
| 36 | MOOSUP | | - 10.9 | ANALYTICAL | 9.6 | I | UD | P | P | N | N | C | N | P | N | N | N | N | N | N | N |
| 37 | GROTON RESERVOIR | | - 4.4 | ANALYTICAL | 1.2 | I | FD | C | U | U | U | C | P | N | U | U | U | U | U | U | U |
| 38 | PAWCATUCK | 10.7 | 11.5 | ANALYTICAL | 80.0 | II | PD | P | U | U | P | C | N | C | N | C | N | N | P | N | P |

WATER USE
FD fully developed
PD partially developed
UD undeveloped

HYDROGEOLOGIC ELEMENTS
C completed
P partial
N needed
U unneeded

* aquifers that are Class III
Work on these aquifers has been suspended until water quality issues are resolved.

PRELIMINARY YIELD and LOW STREAMFLOW FIGURES are in MILLIONS of GALLONS per DAY

## Table 1. Status of Hydrogeologic Investigations of High Yield Aquifers

See Appendix C. for a detailed explanation of the contents of this chart

## Aquifer Integrity Ranking System

**Type I aquifers** - should be excellent quality, few ground water conflicts, could be given high priority for establishing protection programs.

**Type II aquifers** - numerous potential contamination sources which may prevent full utilization of a resource's potential yield. Protection strategies and program implementation should proceed with possible heavy emphasis on inspection and monitoring of existing uses, possible re-zoning to establish non-conforming uses, acquisition of potential wellfield sites and stringent regulation of new uses.

**Type III aquifers** - many ground water quality conflicts, major data acquisition and resource protection efforts is not recommended at this time since the expense of such efforts would be great and successful protection of a wellfield unlikely. Completion of individual water utility water supply plans or regional water supply should be encouraged to consider the potential use the Type III aquifers, and if as a result of such studies, an overwhelming need for developing Type III aquifers is demonstrated, these aquifers could be elevated to Type II. Improved water treatment however, as opposed to the full protection programs alluded to above, may be more appropriate.

Within each aquifer type, distinctions can also be made between resources that have been partially or fully developed for water supply and those which are relatively undeveloped. The need for protection efforts may be more immediate for those resources in which a water supply utility has made a substantial public investment and people are consuming the water. The degree of water supply development may also aid in establishing priorities for continuing studies and program implementation. Therefore, within each aquifer type, water supply development is reflected by:

UD - an undeveloped aquifer (less than 25% potential yield developed);
PD - a partially developed aquifer (25% to 75% of potential yield developed); or
FD - development that has occurred to a significant degree (more than 75% of potential yield developed).

Use of this type of information suggest implementation priorities for potential high yield aquifers as follows:

First Priority: Type I aquifers, water supply use - FD or PD
Second Priority: Type I aquifers, water supply use - UD, and Type II aquifers, water supply use - FD or PD
Third Priority: Type II aquifers, water supply use - UD.

The following table presents the application of this ranking system for all identified high yield aquifers.

## Table 2 - Potential High Yield Aquifers - Preliminary Assessment

| Type I Aquifers | Water Supply Development | Potential Yield (mgd) |
|---|---|---|
| Upper Housatonic Aquifer | UD | 6.0 -10.1 |
| Westport | FD | 6.7 - 7.4 |
| Haddam Meadows Aquifer | UD | 8.0 |
| Willimantic River Aquifer | PD | 10.1 |
| Yantic River Aquifer | UD | 4.9 |
| Moosup River Aquifer | PD | 10.9 |
| Groton Reservoir Aquifer | FD | 4.4 |

| Type II Aquifers | Water Supply Development | Potential Yield (mgd) |
|---|---|---|
| Lower Housatonic Aquifer | PD | 22.6-26.2 |
| Pomperaug Aquifer | UD | 5.0 - 8.8 |
| Pootatuck Aquifer | PD | 4.0 |
| Norwalk | PD | 4.9 - 6.1 |
| Cannondale Aquifer | UD | 3.0 - 4.6 |
| Mill River Aquifer | FD | 9.9 -11.0 |
| Granby Aquifer | UD | 26.2 |
| Simsbury Aquifer | PD | 10.5 |
| Avon Aquifer | UD | 7.5 |
| Farmington Aquifer | PD | 5.7 |
| Plainville Aquifer (Cl. III?) | UD | 8.1 |
| Southington Aquifer | FD | 8.0 -10.1 |
| Hanover Pond Aquifer (Cl. III?) | PD | 6.0 - 8.9 |
| Wallingford Aquifer (Cl. III?) | PD | 11.4-16.1 |
| Somers Aquifer | PD | 5.8 |
| Enfield & Ellington (Cl. III?) | PD | 12.5 |
| Manchester Aquifer | FD | 7.2 |
| Rocky Hill - Glastonbury | UD | 19.8 |
| Dart Island Aquifer | UD | 5.2 |
| Natchaug - Shetucket Aquifer | UD | 10.9 |
| Putnam Aquifer | PD | 11.3 |
| Killingly Aquifer | PD | 4.9 |
| Central Village Aquifer | FD | 5.8 |
| Clayville-Packerville Aquifer | PD | 7.5 - 8.7 |
| Pawcatuck River Aquifer | PD | 10.7-11.5 |

| Type III Aquifers | Water Supply Development | Potential Yield (mgd) |
|---|---|---|
| Waterville & Waterbury Aquifers | UD | 13.5-15.4 |
| Naugatuck Aquifer | UD | 10.2-11.8 |
| Seymour Aquifer | UD | 7.4 -10.6 |
| North Haven Aquifer | UD | 10.2-13.1 |

## CHAPTER III - Implementing a Protection Strategy

There exists a seemingly infinite number of ways to approach the design of management programs to provide greater protection of wellfields, drawdown areas and recharge areas. The simplest approach would be to conclude the present Statewide ground water management program is sufficient and any local government desires to protect beyond this level occur on a voluntary basis. This is where the present program exists, except DEP has increased local assistance efforts over the last three years in an attempt to foster local aquifer protection efforts. The extreme approach would be for State agencies to be given authority for implementing the entire program for both high and moderate yield aquifers, with little or no municipal considerations.

While neither of these extremes are desirable, there is considerable evidence that involving a wide range of governmental agencies is desirable and required. Recent amendments to planning and zoning statutes require municipalities to consider protection of existing and future ground water supplies, but unfortunately doesn't say how, or by what or whose criteria. Numerous municipalities have expressed interest in seeking technical assistance to develop regulatory programs to provide greater protection of their ground water resources.

Many potential sources of contamination are clearly not regulated to the frequency and extent as would be desirable for an effective prevention oriented program, by the Statewide ground water quality management programs. Land use activities, which can result in development posing high risks to ground water quality, have been primarily left to the authority of municipal government. The land use decision making process, a necessary element of any type of ground water resource protection program in Connecticut, almost mandates that protection be accomplished utilizing the skills and resources of both municipal and State government.

Beginning in 1969, the State legislature has determined on three separate landmark occasions, that certain environmental resources that are vulnerable to land use activities, should not be left strictly to municipal government to decide upon its fate. In 1969, passage of the State's Tidal Wetlands Act provided for strict DEP regulation, via a Permit program, of land use activities in tidal wetland resources which were being lost at an alarming rate.

The Inland Wetlands and Watercourses Act, passed in 1972, similarly established a degree of State control over land uses in or effecting inland wetland resources covering approximately 15% to 20% of the State. Municipalities were however allowed to develop their own programs within minimum State regulatory standards.

More recently, passage of the Coastal Area Management Act established that the entire land based coastal environment (within 2,000 feet on mean high water) had statewide significance. As a result, land use decisions being made now must consider minimum State requirements to ensure "Coastal Management Consistency". In this program, considerable DEP overview of municipalities' land use decision making process occurs, and provisions exist for DEP intervention in any local decision deemed inconsistent with criteria mandated by statute.

Conceptually, the protection of wellfields, drawdown areas and recharge areas can be considered in similar manner, i.e. these resources have Statewide significance and existing programs are not designed to provide the higher level of protection needed to establish a truly effective preventative program, able to consider all potential sources of contamination. However, several major differences between new ground water protection program concepts and those resource protection programs mentioned above are that ground water contamination prevention programs must include consideration of existing facilities and activities, and the resource is not easily identifiable as those on the land's surface.

The Housatonic Valley Association report entitled "Study and Recommendations for Regional and Local Aquifer Protection Programs contains many important discussions regarding possible State and municipal authorities and relationships. A second report, also prepared by the Housatonic Valley Association, "Recommendations for a Regionally Significant Aquifer Protection Program", puts forth their independent views of needed authorities and coordination responsibilities for high yield aquifers.

The program contained herein is generally consistent with HVA's regarding the need to heavily involve municipal government. Differences exists though in that HVA did not have the benefit of reviewing DEP's initial computer modeling. Therefore, the HVA report does not give clear direction regarding the ability to distinguish between the establishment of limited drawdown and recharge areas as protection areas, as opposed to general resource protection. DEP also suggests that no regulatory distinctions be made between high and moderate yield aquifers (regional or local aquifers), the only difference should be one of setting priorities for certain State level activities such as conducting additional hydrogeologic studies.

Given the broad range of possible programs that can be considered, and data and analysis limitations preventing definition of the full extent of areas that may be regulated, detailed cost estimates for suggested programs and various program options are not developed. Continued data collection and analysis efforts are recommended for high yield aquifers and these recommendations and other recommendations for short term program development steps are contained in in Chapter IV.

The nature and scope of possible regulatory programs, as described must be subjected to considerable public review. Program concepts, means to foster coordination that would be needed between municipalities, various municipal boards and authorities, private water utilities, and up to four State agencies, i.e. DEP, DOHS, OPM and DPUC and financial considerations will be significant factors in determining how stringent or informal this aquifer protection program will become.

With these caveats in mind, the following discussions focus upon establishing a comprehensive program for the specific purpose of protecting existing and future wellfields, drawdown areas and recharge areas for high and moderate yield coarse grained stratified drift aquifers.

**Acquisition Programs**

Identifying potential wellfield locations is routinely performed by water supply utilities. Unfortunately, only when a relatively short term need exists, such as 5 - 10 years, are these potential sites thoroughly investigated and procured. Although new water supply planning statutes require utilities to consider a 50 year planning horizon, numerous potential wellfields may continue to be lost due to development simply because there exists no State mechanism, such as an acquisition program, or State mandate, that the utilities procure these sites.

Future wellfield sites need to be procured for several basic reasons: 1. acquisition of land provides the maximum amount of protection from contamination; and 2. these sites can be lost simply because land use development results in the construction of buildings and related facilities. The present State Department of Health Services requirement of one acre of land around public water supply wells may not be possible without costly condemnation of developed properties. This development concern can be related to development experiences and needs to protect potential reservoir sites that were identified in the original State of Connecticut **"Proposed Plan of Conservation and Development"**, published in January 1973. Development has since occurred to the extent that numerous potential reservoir sites are no longer viable because of too much development in areas which could have been impounded by constructing dams.

Existing Department of Health Services regulations (Section 19-13-B51d of the Public Health Code) requires for large public water supply wells (greater than 50 gallons per minute) ownership, easement, or other arrangement approved by the Department of Health Services to provide a 200' radius sanitary buffer for water supply protection. This may not be adequate, as this requirement was established when the major drinking water concerns generally involved die off of pathogenic organisms as evidenced by coliform bacteria, which, unlike many of the chemical contaminants found today, are successfully removed in a relatively short travel distance and span of time.

It must be recognized that scientifically derived, uniform wellfield protection areas for the U.S., New England, or other geographic region, are not likely to be developed because of differing hydrogeologic conditions, climatic conditions, land use, potential types of contaminants and other reasons. However, in highly vulnerable ground water resources, such as Connecticut's coarse grained stratified drift aquifers, larger area requirements for maximum wellfield protection is gaining more acceptance. In Rhode Island, for example, utilities must acquire an area having a 400 feet radius around gravel packed wells (approximately 11.5 acres).

It is suggested that an acquisition program to purchase, or otherwise secure potential wellfield protection areas, be in the order of 3 to 10 acres, and possibly larger where warranted by site specific conditions. Partial purchase of drawdown areas could also be provided for. As presented earlier, most high yield wells will have a drawdown area in the order of 20 to 100 acres. Ideally, partial purchase of drawdown areas would be coordinated with municipal and State needs for open space, parks and low intensity recreational uses. In additional, to ensure land procurement at fair market values, there may be merit to requiring acquisition to precede formal procedures to publicly adopt drawdown and recharge areas requiring more stringent regulation.

### Possible Elements of a State Aquifer Acquisition Program

1. State could purchase potential wellfield sites and purchase portions of critical drawdown areas that may not be needed for short term water supply needs (i.e. demand projections and water supply source analyses demonstrate it may not be needed for 20 years or more).

2. State could review with municipalities and other government bodies the potential interim use for this future wellfield as open space, passive recreation, and other recreational uses involving non-intense land use. Property rental or use for other purposes may be also be considered provided no permanent structures are involved and uses are little to no threat to the ground water (see reference document, "Hierarchy of Land Uses Over High and Moderate Yield Aquifers").

3. State could sell all or a portion of an acquired site to a utility when the wellfield is needed for water supply. The property value could be determined by appraisal, consistent with legislative guidance about cost sharing.

### Possible Elements of a Water Supply Utility Aquifer Acquisition Program

1. Utilities could be required to acquire potential wellfields that may be needed within a 20 year planning period. These needs can be identified as individual utilities comply with new DOHS water supply planning requirements.

2. During the preparation, or updating of an individual water supply plan, utilities could review the extent of acquired lands around existing wellfields and availability of additional property for the purposes of providing greater protection, by means of acquisition, for the wellfield.

3. Purchase of property not necessarily associated with the wellfield, but within the drawdown area could also be encouraged and allowed (in the case of a DPUC regulated utility) on a case-by-case basis.

4. As in the possible State aquifer acquisition program, low risk, multiple uses of utility acquired lands could be encouraged.

### Funding Requirements

Initial staff estimates have not been prepared due to the need to publically review the concept of providing State monies to acquire wellfields and portions of drawdown areas. Furthermore, additional hydrogeologic studies are needed to evaluate and confirm potential wellfield sites. The State of Massachusetts' aquifer acquisition program is an example, where a State has authorized $14,000,000 for grants to municipalities to purchase land.

## Acquisition Program Options

During the development of this project, it became apparent that outright purchase was not the only means to secure the retension of open space for critical areas near public water supply wells. Several acquisition program options, reported by HVA, include the following land management techniques.

1. An straight acquisition option could involve "Acquisition of Less than Fee Simple Title", where purchase can involve partial interest in land in the form of conservation easements or relocation of incompatible land use (useful in areas where some development has already occurred, for further explanation see HVA report, pages 38-40).

2. Another option could involve "Transfer of Development Rights" similar to the existing program in the Department of Agriculture. This may not be workable due to the smaller parcels of land to be secured for aquifer protection. Furthermore, Connecticut's land use decision making procedures, will likely continue to be decided locally, but for aquifer protection purposes, be subject to more State scrutiny.

## Protection Area Identification and Approval Process

Under a formal and comprehensive program to protect critical areas, questions involving the technical process of identifying protection areas, and administrative responsibilities and procedures for adopting such areas come into consideration. The process for actions associated with designation of these critical areas could follow administrative steps, generally followed by other DEP program development activities. Simply stated, steps could involve the following.

1. DEP would prepare (or approve) high or moderate yield aquifer maps, at scales useful for municipal planning and zoning purposes, showing wellfield locations, drawdown areas and recharge areas. The maps would reflect hydrogeologic studies and modeling analyses and be presented to affected municipalities.

Where utilities already have developed wellfields, or are actively investigating potential wellfield sites, the utility could be required to accomplish the hydrogeologic data collection, analysis and mapping process. DEP could still be required to develop technical guidelines, review and approve such efforts to assure uniform scientific procedures are followed. Similarly, a process could be established whereby municipalities, through the use of consultants, and possibly State financial assistance, could perform the hydrogeological studies and mapping, subject to DEP review and approval.

2. Municipalities would recommend their own boundaries for protection areas, delineated by roads, property lines or other identifiable natural or man made features, provided such boundaries approximate and in no way diminishes the boundaries identified in 1.

3. DEP would approve or disapprove municipally modified aquifer protection maps.

Administrative review and approval mechanisms would be needed for steps 1-3, and should include requirements for public hearings (mandatory for step 2, perhaps optional dependent on petitioning for steps 1 and 3), appeals and final decision. The remainder of this Chapter discusses various controls that can be placed upon existing and future land uses in those areas actually identified for protection.

### Discharge Prohibitions

Regulation of wastewater discharges is a DEP responsibility and the issuance of Permits to discharge are directlly related to discharge policies established in Connecticut's "Water Quality Standards". Using this system, DEP could re-classify the quality goal for drawdown areas, and possibly recharge areas, to class GAA, GA or some other special designation. Such classifications would have the effect of prohibiting all discharges to the ground water except those associated with domestic sewage and normal agricultural operations.

### Prohibition of Certain Future Land Uses

In drawdown and recharge areas some land uses are not compatible with protecting the wellfield. Drawdown areas, being closest to wellfields could be subject to the most stringent land use restrictions, whereas in recharge areas land use restrictions could be less stringent. Legislation would be needed for the State to mandate certain land use prohibitions and DEP's "Hierarchy of Land Uses Over High and Moderate Yield Aquifers" could be the basis for such legislation. Municipalities could be allowed to adopt more stringent land use prohibitions, subject to review and approval by DEP or DOHS to ensure legislative intents are achieved.

### Municipal Plans of Development, Zoning and Subdivision Regulations

State statutes could be revised to require municipalities to amend Plans of Development, zoning and subdivision regulations consistent with the delineation of drawdown and recharge areas, land use prohibitions and density of development considerations. Certain existing uses, gas stations for example, could be also required to become non-conforming so to force the elimination of certain high risk activities when property or business ownership transactions occur. As stated above, DEP's "Hierarchy of Land Uses Over High and Moderate Yield Aquifers" could be the basis for restricting land uses and identifying non-conforming activities.

Mandatory land use prohibitions, restrictions and non-conforming uses could be limited to the drawdown area, or include the recharge area as well. If inclusion of the recharge area is sought, less stringent requirements could be developed.

Requiring DEP to prepare guidelines for municipalities to "consider" in their planning and zoning process, thereby removing mandatory land use prohibitions, restrictions or non-conforming uses represents a program option that more or less is equivalent to present State program limitations. While this option may meet the literal meaning of recent amendments to planning and zoning statutes that require consideration of ground water supplies (discussed early in this Chapter), DEP believes this option may not provide effective protection of wellfields.

### Best Management Practices or Performance Standards

DEP could develop mandatory Best Management Practices (BMP's) or performance standards for certain existing and future land use activities (i.e. spill prevention plans for commercial and industrial facilities, agricultural BMP's for fertilizer and pesticides use and storage, and BMP's for certain institutional facilities, such as town vehicle maintenance garages). Similarly BMP's or performance standards could be developed for facility related activities such as fuel storage, sanitary sewer construction, storm water management and others. Municipalities could be allowed to make these requirements more stringent.

Examples of BMP's can be found in DEP's "Protecting Connecticut's Ground Water, A Guide for Municipal Officials", dated 1984 (refer to Appendix 4, "Technical Guidelines for Planning and Inspecting Commercial and Industrial Facilities". With additional resources, these guidelines can be updated if needed, and expanded to include additional facilities.

Similar to the land use discussions above, mandatory BMP's or performance standards could be limited to the drawdown area, or include the recharge area as well. If inclusion of the recharge area is sought, requirements could possibly become less stringent, or for certain activities, conform to statewide practices.

### Increased Monitoring, Inspection and Enforcement

Given additional resources, DEP can increase the frequency of inspections of facilities presently regulated by DEP and perform new inspections of facilities posing risks to ground water quality that are largely unregulated at the present time. As allowed by DEP's program delegation statute and implementing regulations, delegation of inspection authorities to municipalities, and possibly to water utilities, may be desirable in certain areas. However it is important to note that accepting DEP's delegation authorities is a voluntary municipal decision, and for purposes of protecting wellfields, considerations to amend this statute to force delegation would neither be acceptable to municipalities, or desired by DEP.

Considerations could be given to requiring water utilities to install ambient ground water monitoring wells along the perimeter of the drawdown area (Public Health Code allows, see Section 19-13-B102(a), or at key locations elsewhere in the special protection areas, such that contamination incidences can be identified prior to it reaching the wellfield.

DEP could also review the need for additional monitoring requirements at high risk facilities, such as landfills, and determine if additional or more frequent monitoring is warranted due to its proximity to the wellfield.

Increased enforcement should naturally accompany with increased monitoring and inspections.

Figure 6 has been prepared to graphically show where and how these different protection mechanisms could actually be applied over a portion of an aquifer. The aquifer resource shown is a generic one, but a demonstration project, such as one using the Canondale Aquifer study in the Town of Wilton, perhaps should be pursued in 1987.

## Implementing Other Protection Mechanisms

Various other support activities could be considered as a means to enhance the protection efforts and coordination amongst the regulators and water supply utilities, or to make sure there is a process to track progress in this program. These support activities are discussed briefly below.

DEP's Diversion Program - Connecticut's Diversion Policy Act, enacted in 1982, could be amended to allow for the reservation an adequate quantity of water from "potential wellfields". The effort and expense associated with the protection of ground water quality should not be circumvented by the issuance of non-water supply related diversion Permits which potentially can affect the quantity of future withdrawals from the potential wellfield.

Utility Planning Programs - Individual Plans and Regional Plans - Due to recent legislative changes, water supply utilities are subject to considerably greater regional and local water supply planning requirements. Utilities could be mandated to consider, as part of these planning regulations, the potential use or expanded use of all high and moderate yield aquifers identified in Chapter II of this report. Utilities could also address, in terms of future needs and timing of needs, the potential wellfields sites which might be identified at a later date by this project. As mentioned in Chapter II, special attention to DEP's "Type III" aquifers are especially requested, because these resources may simply not be worth the vast amount of effort and resources to establish programs of the types discussed above and such efforts should not be sought unless there is demonstrated an overwhelming need to develop for water supply purposes, such resources.

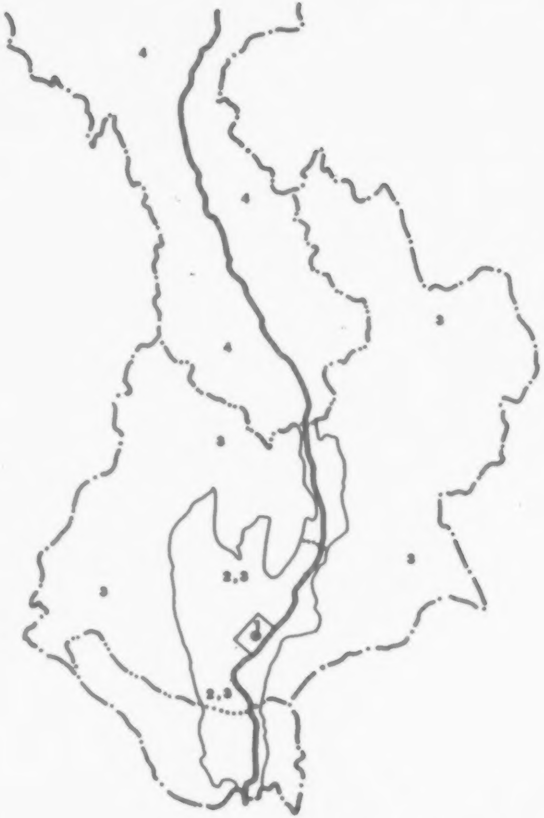
DEP Basin Planning - Basin plans are prepared by DEP's Water Compliance Unit for purposes of developing long term surface and ground water quality management strategies for natural drainage basins of the State. DEP could periodical review the extent and adequacy of ground water quality protection efforts as individual Basin Plans are developed. Although presently the preparation of these plans have been stalled due to other commitments, this program could serve as a type of status report for program implementation. DEP has identified 14 separate "basin planning areas" in Connecticut.

Connecticut's "Conservation & Development Plan" - The establishment of State agency fiscal policy, through the State of Connecticut's "Conservation and Development Policy Plan", could be accomplished to prevent or discourage

State grants and preferential loans being provided to "high risk" facilities in critical areas (i.e. drawdown and possibly recharge areas). Economic incentives to industry are provided by the State Office of Economic Development. These incentives could be determined to be contrary to State policy if potential recipient facilities that are determined to be:

"non-conforming uses" as described previously; or
those that otherwise pose threats to wellfields, as determined by facility type and location in drawdown and recharge areas.

As can be seen from this section, protection of wellfields, drawdown areas, recharge areas and indirect recharge areas for high and moderate yield aquifers involve many different techniques and the program must seek to control both existing and future land uses and related activities. Government responsibilities will need to be shared, however, the State should take the lead for the actual process to identify protection areas and establishing the general types of controls that are needed.



| PROTECTION AREAS | STRATEGIES |
|---|---|
| 1 - WELL FIELD | Purchase |
| 2 - DRAWDOWN AREA | Partial Purchase |
| | Discharge Prohibitions |
| | Prohibition Certain Future Land Uses |
| | Municipal Plans of Development |
| | Zoning |
| | Subdivision Regulations |
| | Best Management Practices |
| 3 - RECHARGE AREA | Discharge Prohibitions |
| | Prohibition Certain Future Land Uses |
| | Municipal Plans of Development |
| | Zoning |
| | Subdivision Regulations |
| | Best Management Practices |
| 4 - INDIRECT RECHARGE AREA | Connecticut Water Quality Standards |

FIGURE 6. STRATEGIES AS MAY BE APPLIED TO DIFFERENT PROTECTION AREAS

## Chapter IV. - Short Term Recommendations

The high yield and moderate yield aquifer protection program described in this report will be resource intensive, involve multiple levels of government and may be viewed as threatening to individual rights of land use and development. It is recommended that the benefits of this comprehensive state and local program be discussed in organized forums over the next year to define legislative, regulatory and financial needs. DEP specifically requests attention of the Environment Committee to the short term tasks which could be accomplished during 1987, as summarized below.

1) Establish a task force of the Environment Committee, DEP and other State agencies (DOHS, DPUC and OPM) and municipalities to bring this program to the public, water supply utilities, economic development interests, environmental protection interest groups, and other interested parties.

The purpose of the Task Force would be to refine, with involvement of the public, the strategies in this report, hopefully achieving general concensus as to need and approach. Any necessary legislation and budget considerations would be introduced in 1988 for program implementation. DEP could provide technical and logistical assistance to facilitate activities of the Task Force.

2) Provide incentives for the development of demonstration projects, such as suggested in Chapter III involving the Canondale Aquifer in the Town of Wilton, using the management areas and techniques described in this report.

Complete hydrogeological analyses have been performed for the Canondale Aquifer and protection areas have been identified. Several other high yield aquifers analyses are nearing completion. Procedures to adopt protection areas, coordinate and implement the full extent of the State and municipal strategies presented, could be put to a test. The experiences gained should provide "real world" insight on the strategies, various strategy options and municipal government response.

3) Provide the resources needed to continue hydrologic data collection, modeling and aquifer protection component area delineation of the remaining high yield aquifer study areas.

The scientific data collection and analysis process must continue outside of debates on protection program strategies. Regardless of the outcome of these public debates, this work is valuable and can be used to refine some of the existing State and municipal programs related to improved resource protection. Debates will more likely focus on the nature and extent of State agency involvement in municipal land use decisions and overall program costs, as opposed to continued analysis of these resources.

4) Support the amendment of the State Public Health Code to increase the area of sanitary protection around the public water supply wells.

The present Health Code requirements (Section 19-13-B51d) were established when the primary health concerns related to pathogenic organisms (i.e. disease causing). These organisms, unlike many of the persistent chemical contaminants found today, are removed in a relatively short travel distance and span of time. Federal EPA guidance, being developed for EPA's new "Wellhead Protection Program", will be available in June of 1987 to facilitate decisions regarding how much additional land purchase may be desirable.

In addition to advancing this project's development, there are some relatively simple initial implementation steps that can be considered by DEP, DOHS and the Environment Committee in 1987. These include.

1. DOHS should require water supply utilities to consider, as part of the individual and regional utility planning processes, the potential use and timing of such use for those aquifer resources identified in Chapters I and II.

2. Continue to promote the development of voluntary municipal aquifer protection programs, with DEP and DOHS assistance in planning process.

3. Provide resources necessary to further development of a series of Best Management Practices, for future use in this program.

Improved protection of critical areas in high and moderate yield aquifers for present and future citizens will be critical to this State. The strategies to define, manage and protect these resources must continue to be refined and implemented commensurate with State and municipal capabilities, and those of privately owned water utilities.

## APPENDIX A.

In order to protect and preserve a resource as complex as an aquifer, it is first essential to delineate the boundaries of the aquifer and to understand the processes governing the flow of ground water in both natural and stressed states that operate on and within it. Definition of the aquifer's geometry and analysis of the hydraulic parameters of the constituent materials are necessary before predictive models can be constructed that will give accurate yield amounts and allow for reliable analyses on the effects of pumpage on water table configurations and interactions with surface water bodies.

Work being conducted by the Natural Resources Center of the Department of Environmental Protection in the delineation and hydrogeologic evaluation of high yielding stratified drift aquifer-stream systems in Connecticut has been divided into three main tasks including; Background Information, Hydrogeologic Elements and Modelling. Each of these tasks has been broken into a number of individual but interrelated jobs (see Table 1. in the main body of this report).

The first task, Background Information, deals with the selection, identification and preliminary classification of 38 areas in the state that have the potential to yield large amounts (approximately 5 million or more gallons per day ) of ground water to wells. The collection of information contained in this task was from a literature search of a number of sources and is essentially complete for all 38 high yield aquifers. The following job elements in this task are defined as follows:

1. Preliminary Yield - in millions of gallons per day, an estimate of the amount of water available from the aquifer. Depending upon the method used a potential high and low yield may be given.
2. Model Type - the method by which the preliminary yields were determined. Analytical models are of two types and solutions are in terms of yields for wells or the total aquifer only. The digital models give yields and also the effects of pumping on the environment.
3. Stream Low Flow - in millions of gallons per day, was calculated in order to assess water availability in the aquifer.
4. Aquifer Class - refers to the water quality based on existing known discharges as discussed in the main body of the report.
5. Water Use - refers to the extent of present pumpage for public supplies in the aquifer. If less than 25% of the preliminary yield is being pumped the aquifer is considered undeveloped, if more than 75% is being pumped the aquifer is considered fully developed and if pumpage is between 25% and 75% the aquifer is considered partially developed.

The Hydrogeologic Elements task can be subdivided into two groups of job elements; the collection of basic hydrogeologic data and the interpretation of that data into maps of aquifer boundaries and properties. Basic data being collected includes the following:

1. Inventory - All material collected in previous studies including the geologic logs of wells and testborings, seismic data,

pump test data and geologic and hydrogeologic maps.

2. Geophysics - Field collection of data on aquifer properties by use of seismic refraction, seismic reflection and ground-penetrating radar methods. This operation is being conducted in cooperation with the United States Geological Survey.
3. Borings - testborings are being drilled by contract to evaluate the potential of aquifer materials to store and transmit water as well as to define aquifer geometry.
4. Quality - existing water quality data is available at sites where public supply wells exist. To date no samples have been analyzed specifically for this project.

Interpretive aspects of the Hydrogeologic Elements task include:

1. Saturated thickness - the production of maps that show the water saturated thickness of the aquifers. These maps show the aquifer boundaries.
2. Hydraulic conductivity - maps showing the average rate at that water moves through the aquifer.
3. Transmissivity - a product map of saturated thickness times hydraulic conductivity. Transmissivity is used in analytical modelling.
4. Stream-aquifer connection - potential for the exchange of water between the aquifer and a surface water body. The efficiency of the connection will determine the potential for a well to induce streamflow.
5. Potential Well Fields - the location of areas that are most conducive to the development of high yield wells. These are the thickest and most transmissive areas with the most efficient stream to aquifer connection.

The third task, Modelling, deals with the mathematical simulation of the aquifer, predicting of well yields and the evaluation of the effects of pumpage on the stream-aquifer system. The job elements are as follows:

1. Nonpumping Model - The construction of two-dimensional digital models to simulate the ground-water flow system and its behavior under nonpumping conditions.
2. Calibration - the matching of model generated output to field observed behavior of the aquifer and the fine tuning of model input to obtain the best possible fit.
3. Well Site Selection - The selection of the best sites and construction characteristics of individual wells
4. Pumping Model - The construction of a predictive model. Hypothetical wells are input into the existing model and predictions of well yields and effects of pumping are simulated.
5. Pump Test - Verification of the pumping model through limited field pump testing.

Because of the complexity and costs of the job elements in this task, coupled with time and fiscal constraints of this study, it is expected that only three of the thirty-eight aquifers will reach completion of this task in this phase of the aquifer protection program.